Public Health England

Protecting and improving the nation's health

Calorie reduction: The scope and ambition for action

March 2018

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Published March 2018
PHE publications
gateway number: 2017818

PHE supports the UN
Sustainable Development Goals

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Executive summary

We are on average consuming too many calories on a regular basis. This increases our chances of becoming overweight and obese which is a leading cause of poor health and premature death. Obesity and overweight-related ill health are estimated to cost the NHS £6.1billion annually.

Childhood overweight and obesity is a significant issue affecting over one-third of children when they leave primary school. Children in the most deprived areas have double the rates of obesity of those in the least deprived areas. Being obese in childhood increases the chance of being obese as an adult with around two-thirds of men and women now overweight or obese.

‘Childhood obesity: A plan for action’ was published in August 2016. Amongst the government’s commitments was for Public Health England (PHE) to lead a structured, and closely and transparently monitored, programme to improve everyday food and drink. This was to be carried out through the revision and reformulation of products to lower the levels they contain of sugar, salt, calories and saturated fat (pending a review of current dietary recommendations).

Action of this kind has already proven to be an effective strategy for improving diets at a population level, providing the most commonly consumed foods are changed. Product reformulation also places the least burden on the public in terms of improving diets as everyday foods are changed so there is no need for individuals to consciously review and sustain changes to what they eat. Indeed many do not notice the changes made, particularly if these are gradual and are made across the food chain. By working in this way the UK’s salt reduction programme has seen reductions in foods of up to 50% and the lowering of average intakes by 11% between 2005 and 2014.

To date the wider reduction and reformulation programme announced in August 2016 has challenged industry to reduce the amount of sugar coming from foods that children up to the age of 18 years consume the most by 20% by 2020. Industry guidelines to facilitate this ambition were published in March 2017. A number of big businesses and household brands have already reduced, or committed to reducing, the amount of sugar in their top selling products either through product reformulation or by reducing portion size.

The foods included in the sugar reduction programme account for around 25% of children’s calorie intakes. However, if children’s currently excess calorie consumption is to be reduced, and obesity trends reversed, a broader programme is needed.

PHE were therefore commissioned in August 2017 to consider the evidence around children's calorie consumption and to set the ambition, scope and timeline for extending the reformulation programme to cover the foods that contribute significantly to children's calorie intakes. This document sets out the detail on these.

The evidence set out here first illustrates the recommended levels of calorie intake published by the Scientific Advisory Committee on Nutrition in 2011. Weight gain happens when calorie intakes are habitually above requirements for health. Although evidence shows that people are consuming more calories than they require as body weights are above the ideal, when monitoring the number of calories people actually eat, dietary surveys suggest that calorie intakes are below recommendations. This mismatch is seen because survey respondents do not record everything they usually eat and drink meaning surveys are unable to provide a true reflection of calorie consumption. Additionally, those who are overweight and obese are more likely to underreport their consumption, meaning that issues with underreporting will increase as the population continues to gain weight.

Separate analysis was therefore necessary to identify the true picture of excess calorie consumption. Analysis included in this report shows that on average, compared with those with healthy body weights, overweight and obese children consume substantial amounts of excess calories every day, above what is required for a healthy body weight. These vary between 140 and 500 excess calories per day, depending on their age and sex. At a population level, on average, adults also consume 200-300 excess calories a day. These figures are conservative estimates as the analysis assumes no further weight gain occurs. This means that for many the number of excess calories they consume will be higher. In reality the prevalence of excess weight increases throughout childhood and for adults, being highest among adults between the ages of 45 and 74.

As well as these data, when setting the plans for the calorie reduction programme PHE also considered a range of other evidence. This includes insights and achievements from earlier reformulation programmes and the results of an initial stage of engagement with 21 leading businesses across all sectors of the food industry (according to market share), and 1 non-government organisation that represents around 40 public health bodies. Consumers' perceptions and understanding of calories, and their views of the actions that could be taken to address the current obesity problem, have also been taken in to account. This shows that there is public support for the government working with businesses to develop products with fewer calories and in smaller portions. Finally an economic assessment was conducted to identify the benefits of implementing a calorie reduction programme. The result of these considerations is the calorie reduction programme outlined in this document.

The calorie reduction programme challenges the food industry to achieve a 20% reduction in calories by 2024 in product categories that contribute significantly to children's calorie intakes (up to the age of 18 years) and where there is scope for substantial reformulation and/or portion size reduction. This requires work to be undertaken by retailers and manufacturers, restaurants, pubs, cafes, takeaway and delivery services and others in the eating out of home sector. The products covered by the programme include ready meals, pizzas, meat products, savoury snack products, sauces and dressings, prepared sandwiches, composite salads and other "on the go" foods including meal deals. It does not cover foods included in the sugar reduction programme. Shifting consumer purchasing towards lower calorie options provides an additional mechanism for action.

The health and economic benefits of reducing the calorie content of these foods and excess calorie consumption are significant. A 20% reduction in calories from everyday foods that contribute to intakes, if achieved over 5 years, would prevent 35,370 premature deaths, save the NHS £4.5 billion healthcare costs and save social care costs of around £4.48 billion, over a 25 year period.

Businesses are encouraged to start work now to reduce the calorie content of everyday foods included in the calorie reduction programme. PHE will support their efforts by setting guidelines for products; establishing baseline calorie levels in each food category; and regularly reporting progress across the different sectors, food categories and for the top contributing businesses and products. The year ending August 2017 will be the baseline against which progress will be measured. PHE will advise government if progress is not being made.

PHE will engage with stakeholders over the coming months to set specific product category guidance, using a sales weighted average approach across broad food categories which focus on top selling products. These will be published in mid-2019. PHE will also consider whether separate guidance for the eating out of home and takeaway/delivery sectors is required in order to achieve the same level of ambition. In parallel to these discussions and the setting of guidance for industry, including for smaller businesses, PHE will discuss with stakeholders the metrics and analyses that will be used to monitor the programme.

The UK nations recognise the need to focus on calories and the purpose of a calorie reduction programme. PHE will continue to involve them closely in the further development of the programme and forthcoming guidance to industry.

The calorie reduction programme focuses on large businesses that are providing the greatest volume of foods and consequentially calories into the food chain. Taking action to reduce calories in this way will incorporate foods providing an additional 19% of the calories consumed by children into the reduction and reformulation programme.

Together with the sugar reduction programme (25% of calories) and drinks (5% of calories which come from drinks that are included in the soft drinks industry levy and PHE's separate programme), this will broadly account for 50% of children's overall calorie intakes.

Although the programme focuses on foods consumed by children up to the age of 18 years, the reality is that families eat the same foods. This programme will therefore support all family members in reducing their calorie consumption, particularly with continued support through for example the Change4Life and OneYou campaigns. It should also help to address health inequalities, as rates of obesity in children tend to be highest in the most deprived. PHE will therefore seek to gather evidence of the impact of the programme across all economic and geographic groups.

Achievement of the calorie reduction programme's ambitions offers a significant opportunity to address excess calorie intakes in children, and the consequent health harms, and to deliver significant health and economic benefits. However, any significant progress in reducing calorie intakes would yield benefits.

Introduction

Obesity and health

In 2016/17, almost a quarter (22.6%) of children in primary school aged 4-5 years, and over one-third (34.2%) aged 10-11 years, were overweight or obese(1) (figure 1). Obesity is a concern across all age and sex groups, but prevalence for children living in the most deprived areas in both age groups is more than double that of those living in the least deprived areas (figure 2). This gap has increased over time for both age groups of children and has continued to widen.

There is also some variation in obesity prevalence between ethnic groups. For example, obesity prevalence is highest in children of black ethnicity at 14.8% in Reception and 29.5% in Year 6(1).

The most recent Health Survey for England, in 2015/16, found that 58% of women and 68% of men were overweight or obese(2).

Figure 1: Body Mass Index status of children by age, National Child Measurement Programme 2016/17(1)

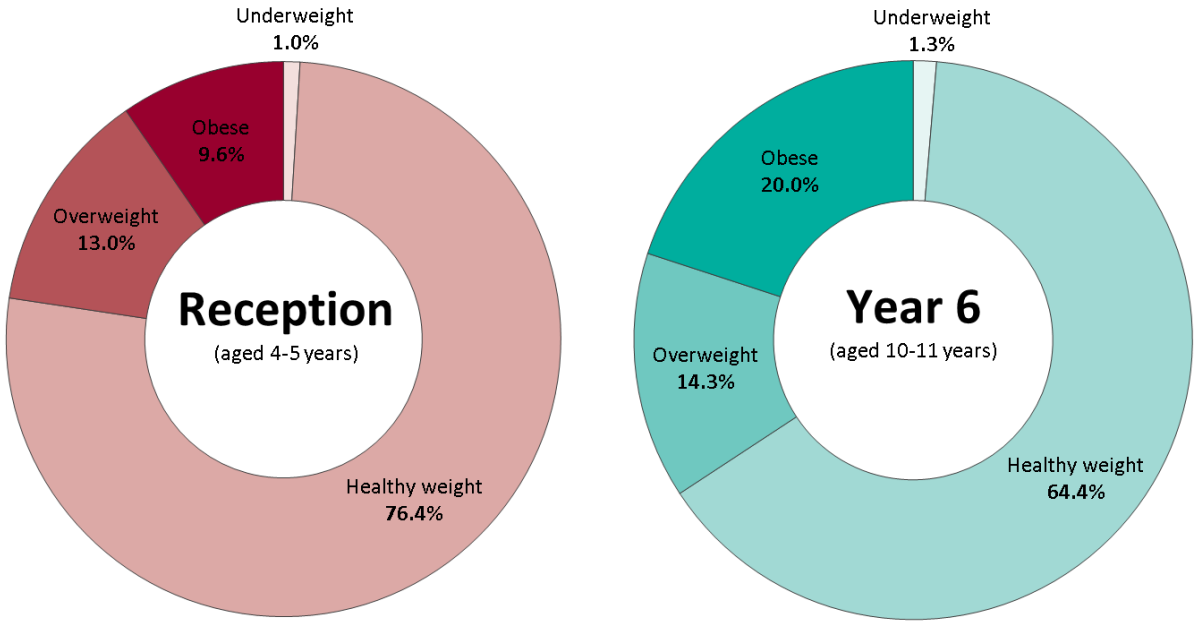
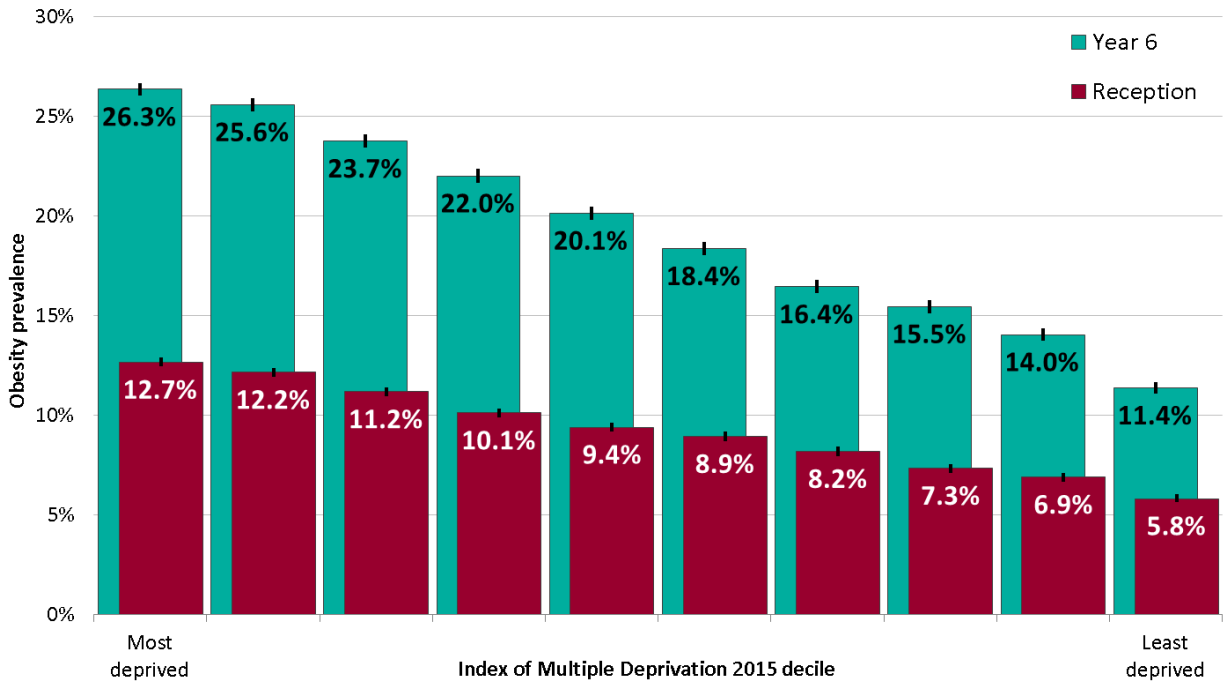


Figure 2: Obesity prevalence by deprivation decile, National Child Measurement Programme 2016/17(1)



Obesity in children and adults leads to a range of health and social problems. Children who are obese are more likely to be obese adults(3). Excess weight increases the risk of conditions such as heart disease, some cancers and type 2 diabetes in adulthood(4). Children who are overweight or obese are also more likely to experience bullying, stigmatisation and low self-esteem(5). The high prevalence of overweight and obesity in England means that it is now a leading cause of avoidable illness and premature mortality(6). Consequently the economic impact is high; for example, it is currently estimated to cost the NHS £6.1 billion per year (7).

The average person in England is now overweight. This means that they have, over time, consumed consistently more calories than they require to maintain a healthy weight, and they are storing the excess mainly as body fat. However, consuming a healthy diet means making food choices that are in line with both calorie requirements and the principles of a healthy, balanced diet as set out in the Eatwell Guide and the underpinning government recommendations (8-10). On average, diets in the UK are not in line with these principles and contain too much sugar, saturated fat and salt and not enough fibre and fruit and vegetables(11). Poor diet, independently of obesity, also increases the risk of a range of diseases including some cancers and heart disease, and was estimated to cost the NHS £5.8 billion per year in 2006/07(7).

The Food Environment

The food and drink we eat, and our patterns of eating, have changed a great deal over the last 50 years(12). As a result of advances in technology, economic development and other factors, the food and drinks market has evolved to provide more choice and availability than ever before. We are constantly nudged to buy and eat more food through food advertising, promotions and the high density of food outlets on our high streets (shops, restaurants, takeaways and fast food restaurants, cafes and coffee shops) (13, 14).

The density of fast food outlets has also increased sharply in England(15). On average, there are more fast food outlets in deprived areas than in more affluent areas, with many consumers believing that food is too easily available(16). The eating out of home sector (eg cafes, restaurants, pubs etc), provides 20-25% of an adult's energy intakes(17).

Purchasing of ready meals has increased(12) and portion sizes in cafes, coffee shops restaurants, etc. tend to be larger than food sold by retailers(18). Foods that are high in sugar or where sugar has been added tends to be most highly promoted (19) and advertised (20). There is convincing evidence that high intakes of very calorific and energy dense foods that are high in fat and/or sugar specifically, similar to the current UK diet, increases the risk of gaining weight and becoming overweight (21-23). Physical activity can help with weight maintenance but to tackle obesity it is vital to target changes to diet.

Education and having information available to consumers, for example nutrition information being consistently available at the point of choice or purchase when eating out of the home or when choosing a takeaway or delivery, can also help to guide consumers towards better, healthier choices(24). This view is supported by a recent Cochrane Review which showed for a typical lunch with an intake of 600 calories labelling calories at the point of choice may reduce the energy content of food purchased by about 8% (48 calories)(25) .

The food environment, which currently encourages us to buy and consume more food and drink(23), needs to change so that the healthier choice becomes the default choice for people to make and is accessible, available and affordable. And while many perceive that it costs more to eat healthily, analysis suggests that although achieving the diet set out in the Eatwell Guide would require large changes to the average diet, these changes would not cost more than current dietary patterns (12, 16) (26).

In August 2016, the government published 'Childhood obesity: a plan for action'(27) , its commitment to tackling childhood obesity. This included a key commitment for Public Health England (PHE) to lead a sugar reduction and wider reformulation

programme. It aims to reduce the sugar content of everyday foods and to help move the population sugar intakes downwards towards recommendations set by the Scientific Advisory Committee on Nutrition (SACN)(22). The initial commitment was to challenge all sectors of the food industry (retailers, manufacturers and the eating out of home sector eg restaurants, cafes, takeaways and delivery services) to achieve a 20% reduction by 2020 in the sugar coming from the food categories that contribute most to the intakes of children up to the age of 18 years. The programme is now underway and guidance was published in March 2017(18).

There was also a commitment for the wider reformulation part of the programme to cover calories as well as salt, saturated fat (pending expert advice from SACN(28) and the drinks excluded from the soft drinks industry levy. In August 2017, one year on from the publication of 'Childhood obesity: a plan for action', PHE was formally commissioned by government to start work on the calorie reduction aspect of the programme(29).

Scope of this report

This document provides the first major milestone for the calorie reduction programme. It sets out the evidence on children's calorie consumption and why action is needed to reduce the number of calories they, and their families, eat every day. The evidence presented below therefore includes data and information on adults as well as children.

In doing so, this document sets out:

1. The evidence around children's calorie consumption covering:

- dietary references values for energy, sources of calories in the diet and reported levels of calorie intake for children and adults
- estimates for energy intakes for children and adults
- evidence on reformulation and portion size reduction
- public perceptions and attitudes to calories
- how the calorie reduction programme was developed
- estimated health economic benefits of a calorie reduction programme

2. The programme of work PHE will take forward to reduce calories in everyday foods which covers:

- the overall ambition, structure and timeline for the programme
- the food categories included in the initial phase of the programme
- suggested mechanisms for industry to use to reduce calories in foods

3. Conclusions and next steps

Background

What is a calorie?

The food and drink we consume contains energy which is measured in kilocalories (kcals) and kilojoules (kJ) although the short hand term calories is often used. Both are presented on food labels. The energy content in kilojoules can be calculated by multiplying the kilocalorie figure by 4.2. The 2 terms ‘energy’ and ‘calories’ are used to mean the same thing throughout this document.

Energy is provided by the carbohydrate (including fibre), protein, fat and alcohol in the food and drinks we consume. Each of these provides varying amounts of calories per 1 gram of carbohydrate, protein, fat or alcohol which is detailed in table 1(8).

Table 1. Energy provided by different nutrients and alcohol

Macronutrient	**Amount of calories provided per 1g of macronutrient (kcal)**	
	Kilocalories (kcals)	**Kilojoules (kJ)**
Fat	9	37
Protein	4	17
Carbohydrate	4*	17
Fibre	2	8
Alcohol	7	29

*FAO/WHO/UNU recommended that when carbohydrate is expressed as monosaccharide equivalents, a conversion factor of 16 kJ/g (3.8 kcal/g) should be used, and when determined by direct analysis, this should be expressed as the weight of the carbohydrate with a conversion factor of 17 kJ/g (4.0 kcal/g); the latter value being an estimated average of the different forms of carbohydrate in food (8, 30).

Body weight

Body weight is dependent on the balance between how many calories we consume from food and drinks and the total energy that is expended by the body. Weight is gained when energy from food and drinks is greater than that expended to maintain our bodies and through physical activity; excess calories are stored in the body mainly as fat. Weight is lost when energy intakes drop below our needs, as we then use the energy stored in the body.

Body Mass Index (BMI) is calculated by weight in kilogrammes divided by height in metres squared [weight (kg) / height (m2)]. It is used to standardise body weight for different heights. In general BMI increases as body fat is gained. For adults, BMI values between 18.5 and 24.9 are defined as being a healthy weight while values at or above 25 to 30 being classified as overweight and obese respectively(31). For children, excess weight was determined from comparison with best estimates of healthy body weights (32).

The evidence on children's calorie consumption

Dietary Reference Values for Energy

In 2011 the Scientific Advisory Committee on Nutrition (SACN) set guidelines for the number of calories that each age and sex group should consume on a daily basis, known as Dietary Reference Values (DRVs) for energy(8). These were set as Estimated Average Requirements (EAR) – this is an estimate of the average requirement for energy across UK population age and sex groups. The guidelines were set at levels of energy intake required to maintain a *healthy* body weight for otherwise healthy people at what were current levels of physical activity at the time the EARs were set. Further details of how SACN set the guidelines can be found at appendix 1.

As the EAR for energy is set at a level of calorie intakes to maintain a healthy body weight then if those groups of the population that are overweight, eat in accordance with SACN's recommendations, they will tend to lose weight and move towards being a more healthy weight.

The EARs set by SACN for children are set out in Table 2. These values include allowances for growth and development. They are intended to be used as a guide to energy intakes as actual requirements for individuals will depend on many factors such as physical activity levels and health issues. This means that individuals may actually require more or less than the age-appropriate requirement figures. It is also important to note that while these requirements have been set for children at a healthy body weight and current average heights, a substantial proportion of children are heavier than this.

While younger children require fewer calories than adults, during adolescence requirements are equal to or higher than those for adults. The main reasons for this are to provide allowances for growth and development during adolescence; and because of body composition and average levels of physical activity differences in adolescents compared to adults. However, energy intake figures for those aged 11 and over (including average, physically active adult men and women) have been capped at 2500kcals (10.5MJ)/day for males and 2000kcals (8.4MJ)/day for females to help address issues of overweight and obesity. These have been accepted as part of general government recommendations(10). It should also be noted that while it is important to ensure that children have the amount of energy they need, a healthy balanced diet is also important for their overall health and wellbeing. A number of resources are available for this purpose (9, 33).

Table 2: Population Estimated Average Requirements (EAR) for children aged 1-18 years old*(8)

	EAR kcal/d	
Age (years)	**Boys**	**Girls**
1	765	717
2	1004	932
3	1171	1076
4	1386	1291
5	1482	1362
6	1577	1482
7	1649	1530
8	1745	1625
9	1840	1721
10	2032	1936
11	2127	2032
12	2247	2103
13	2414	2223
14	2629	2342
15	2820	2390
16	2964	2414
17	3083	2462
18	3155	2462

* Calculated from BMR x PAL. BMR values are calculated from the Henry equations, using weights and heights indicated by the 50th centiles of the WHO Child Growth Standards (ages 1-4 years) and the UK 1990 reference for children and adolescents. PAL values used varied by age and were adjusted for growth.

Sources of calories in the diet

The National Diet and Nutrition Survey (NDNS) (years 5 & 6 combined, 2012-13 and 2013-14) shows that, in general, the main sources of energy in the UK diet are similar for both children and adults (11). These include foods covered by PHE's sugar reduction programme (cakes, biscuits, breakfast cereals, yogurts, ice cream, morning goods (eg pastries and buns) confectionery (sweet and chocolate), puddings and sweet spreads and sauces) which account for about 25% of calories consumed with a further 5% coming from the drinks included in, and excluded from, the soft drinks industry levy(11, 18, 34).

Analysis of the NDNS data shows that cereals and cereal products are the main source of energy in all age groups contributing 37% of total energy intake for the 4-10 and 11-18 year age groups, with the main contributing foods being bread, pasta, rice

and pizza, breakfast cereals and biscuits, buns, cakes, pastries and puddings. The 4-10 and 11-18 age groups obtained 15% and 10% of energy intake from milk and milk products, and 13% and 16% of energy from meat and meat products, respectively. Smaller contributors are vegetables and potatoes (9-10% of energy intake), table sugar, preserves and confectionery (5-6%) and soft drinks and fruit juice (4-7%)(11).

Dietary surveys show some differences in the diet by income and other socio-economic measures. Generally people in lower income groups tend to have poorer diets than those in higher income groups although the differences are generally small and are not seen for all foods or nutrients. The differences tend to be most marked for fruit and vegetables and fibre and some micronutrients. Analysis of National Diet and Nutrition Survey data by household income quintile shows lower consumption of fruit and vegetables, fibre and some vitamins and minerals in the lowest income quintile compared with the highest(35). This analysis also shows higher sugar intake in the lowest income quintile for adults although not for children. There is little or no evidence of income or other socioeconomic differences in saturated fat or salt intakes.

Reported levels of calorie intake

Misreporting in self-reported dietary methods is a well-documented issue and common to all dietary surveys(36). Underreporting may result from a number or combination of behaviours, for example omitting to record foods or drinks consumed, whether intentionally or otherwise; underestimating quantities consumed; or changing usual consumption as a result of being asked to record the diet(35).

Underreporting of food intake is significant and particularly pronounced in overweight and obese individuals (37, 38). Thus, the proportion of the population likely to under-report increases as the population gains weight, thus exacerbating the problem of underreporting of energy intakes (39, 40).

Current estimates of UK energy intakes from the NDNS show that mean reported energy intakes are 18-20% below the SACN estimated average requirements (EAR) in all age and sex groups, except for children aged under ten years when reported figures tend to be close to the EAR. Given the prevalence of overweight and obesity in the population, it is clear that many people are consuming more energy than they require and are storing excess energy mainly as body fat. It is therefore unlikely that population energy intakes are below requirements. The low reported intakes are likely to be due to underreporting. Estimates of current energy intakes have therefore been calculated using a different methodology that does not rely on self-reported diet and are given in the next section of this document.

The NDNS methodology includes actions to reduce underreporting as much as possible but it cannot be removed completely and will always be an issue in self-reported dietary assessments worldwide. Despite underreporting, meaning that some care is needed in the detailed interpretation of data, the NDNS remains the best available and most robust source of information on dietary intakes in the UK.
One of the ways in which underreporting can be better understood, and potentially mitigated for, is through the use of doubly labelled water (DLW). Doubly labelled water is the most accurate research method for measuring people's energy expenditure while they go about their everyday lives. The amount of energy expended by the body equates to energy intake when body weight is stable. The DLW technique provides an indication of the extent to which reported energy intake is likely to reflect usual energy intake and/or an indication of the degree of under reporting. A DLW study using a subsample of NDNS participants showed that reported energy intake in adults was on average 34% lower than energy expenditure measured by DLW – clearly demonstrating the degree of under reporting that occurs, although there was a wide variation between individuals(35, 41). More detail about the DLW method can be found in appendix 2.

Estimating energy intakes for children and adults

Due to the problem of under reporting in dietary surveys an accurate estimate of calorie intake through other means is needed. This is best made through calculations using standardised equations to derive energy expenditure which is the methodology used here(8).

PHE undertook a series of analyses to calculate and determine the proportion of overweight and obesity, average excess weight (kg), and estimated energy intakes for children and adults. Standard equations with height and weight data from the Health Survey for England (HSE 2012-2014)(40) were used. Further details on the methods used, including the quality assurance and peer review procedures, can be found in appendix 3.

For children, the analysis was undertaken in 3 age categories: 4-10, 11-15, and 16-18 year olds, and separately for boys and girls. For adults, the estimates were calculated for males and females aged 19-30, 31-60 and 61+ years. For children, those with a BMI ≥85th centile of the UK-WHO growth charts for children (0-18 years)(32) and for adults those with a BMI ≥25, were defined as obese or overweight.

The analysis showed that around a quarter of primary school children and a third of adolescent children were overweight or obese (Table 3). Primary school children had around 2kg of excess weight when compared to being a “healthy weight” (at the high end of the healthy weight range and corresponding to the 85th centile, above which children were defined as overweight or obese); and 5-6kg excess weight when compared to being of an “ideal” weight for their age and height (corresponding to the 50th centile, seen as the ideal standard of body weight and different to the general current status). The older the age group, the greater the amount of excess weight they were carrying.

On average, compared with those with ideal body weights, overweight and obese children consumed between approximately 140 and 500 excess kcals per day for boys and between 160 and 290 excess kcals per day for girls, depending on their age.

Overall, on average, adults consumed approximately 195 excess kcals per day, and overweight and obese adults approximately 320 excess kcals per day. When split by age group (19-30, 31-60 and over 60 years, Table 4), overweight and obese women consumed between approximately 250 and 300 excess kcals per day, and overweight and obese men consumed between 360 and 425 excess kcals per day, compared with

those with an “ideal” body weight (a BMI equivalent to 22.5 and distinct to a “healthy” weight for adults which goes up to a BMI equivalent of 24.9).

However, energy intake figures for those aged 11 and over (including average, physically active adult men and women) have been capped at 2500 kcals (10.5MJ)/day for males and 2000 kcals (8.4MJ)/day for females to help address issues of overweight and obesity (10)

The excess calorie figures have been calculated using the Scientific Advisory Committee on Nutrition’s estimated average requirement (EARs) for energy intakes. For older boys and girls (aged 11-15 year and 16-18 years) these EARs exceed the government’s capped energy intake figures for those aged 11 and over. As a result the excess calorie figures included here may represent underestimate for these age groups. In addition, this analysis assumes that overall prevalence of different weight status remains constant. However, as most of the population is gaining weight year on year, with prevalence being highest in adults between the ages of 45 and 74, the figures presented here are likely to be underestimates(42).

Excess calorie intakes have not been estimated for different socio-economic groups but given the higher prevalence of excess weight in children who live in deprived areas compared to more affluent areas it is likely that calorie excesses are likely to be similarly patterned.

Table 3. Proportion of overweight or obese children aged 4 to 18 years, their average excess weight (kg) and estimated energy intakes[1] (kcal) by age band, gender and weight status[2]: HSE 2012-2014

		All children			Overweight or obese					
Gender	Age bands (years)	EAR[5]	Energy intake	Excess calorie intake	Proportion overweight or obese	kg to healthy weight[3]	kg to ideal weight[4]	EAR[5]	Energy intake	Excess calorie intake
Boys	4-10	1690	1710	21	26%	2.1	5.4	1724	1871	146
	11-15	2598	2667	69	33%	6.6	14.0	2636	3133	498
	16-18	3128	3232	104	32%	9.1	18.6	3115	3621	505
Girls	4-10	1575	1609	34	25%	2.3	6.0	1603	1760	157
	11-15	2302	2365	63	33%	6.5	13.9	2306	2536	229
	16-18	2455	2499	44	35%	9.2	17.5	2458	2748	291

1. Estimated as BMR X PAL using HSE height and weight data with Henry equations to predict BMR and population reference PAL values (adjusted for growth costs). Excess is the difference between energy intakes and the EAR.
2. Each respondent's BMI has been mapped onto the corresponding centile of the UK1990 growth reference data. The sample was then split into those being equal to or greater than the 85th centile and those less than the 85th centile of BMI.
3. Median excess kilograms to correspond to the 85th UK1990 BMI centile.
4. Median excess kilograms to correspond to the 50th UK1990 BMI centile.
5. Estimated as BMR X PAL with BMR predicted from current (HSE) heights and ideal weights, calculated as weights predicted for these heights from mid-year 1990 reference BMI values.

Table 4. Proportion of overweight or obese adults aged 19+ years, their average excess weight (kg) and estimated energy intakes[1] (kcal) by age band, gender and weight status[2]: HSE 2012-2014

		All adults			Overweight or obese					
Gender	Age bands (years)	EAR[5]	Energy intake	Excess calorie intake	Proportion overweight or obese	kg to healthy weight[3]	kg to ideal weight[4]	EAR[5]	Energy intake	Excess calorie intake
Men	19-30	2758	2919	161	47%	9.7	17.7	2754	3179	425
	31-60	2626	2911	285	73%	12.0	19.8	2621	3000	379
	>60	2346	2638	292	78%	11.8	19.1	2343	2706	362
Women	19-30	2217	2296	79	43%	10.0	16.6	2203	2500	297
	31-60	2107	2239	133	60%	11.5	18.2	2098	2350	252
	>60	1892	2056	164	68%	11.0	17.3	1885	2136	251

1. Estimated using HSE height and weight data with Henry equations and average derived PAL values.
2. Sample split into those with a BMI equal to or greater than 25 and those with a BMI of less than 25.
3. Median excess kilograms to correspond to BMI of 25.
4. Median excess kilograms to correspond to BMI of 22.5.
5. The revised population EAR values for adults to maintain an ideal BMI, calculated using a PAL value of 1.63. This should apply to all adults, unless energy expenditure is impaired due to immobility or chronic illness.

Reformulation and portion size reduction

The National Diet and Nutrition Survey (NDNS) shows that the average UK population's diet does not match recommendations(41) and is high in sugar, salt and saturated fat, and lower in fruit and vegetables, oily fish and fibre than is recommended. It is also estimated that calorie intakes exceed recommended levels for many (see the section on "Estimating energy intakes for children and adults" earlier in this report). Those in lower income households have lower than average consumption of fruit and vegetables and fibre, with adults also having higher intakes of sugar, when compared to households with the highest income levels. In addition to obesity, the average UK diet is a leading factor in many diseases such as heart disease, stroke, type 2 diabetes and some cancers.

Reformulating product recipes (eg reducing salt or sugar levels, and/or reducing calories, per 100 grams of food and drink) and/or reducing portion sizes can help consumers lower their intake of those nutrients that contribute to poor health (43-45). There is also recent evidence that supports reformulation to reduce energy density in food (calories per 100g of food) as a means to successfully reduce calorie intakes (44).Working in this way can help children, adults and families of all socio-economic groups to have a healthier diet and remove some of the burden of consciously changing their usual eating habits and patterns.

Lessons from the salt and sugar reduction programmes

The UK's salt reduction programme, currently led by Public Health England, has been successful in driving down population intakes of salt by 11% between 2005 and 2014(46). This has been primarily achieved through the reformulation of food and drinks products by food businesses to reduce salt levels present.

The main factors that contributed to the success of the programme include:

1. Taking action across the food chain so that whole product categories were improved (although there was limited input from the out of home and takeaway sectors particularly in the early days of the programme). Working in this way has the advantage of keeping the playing field even and does not have to affect competitiveness.
2. Salt was taken out of most foods and not replaced or added back elsewhere – gradually most everyday products became less salty and consumer preference for salty foods was therefore also reduced.

3. Setting targets for levels of salt in a wide range of foods and refreshing these on a regular basis so that salt levels were gradually moved downwards
4. Monitoring effectively and consistently across all industry participants. The universality of this approach allowed the effect of salt reduction to be estimated and checked (47)

The programme included a number of phases of consumer awareness work to highlight why high salt intakes were bad for health and what actions consumers could take to reduce their intakes. This activity also contributed to industry engagement as businesses felt it was important for consumers to understand why food products may change.

There was also some substantial engagement with other countries that were considering implementing similar programmes, as well as through the European Commission and the World Health Organization (WHO) (47, 48). WHO has described the UK's salt reduction programme as being amongst country interventions that are "world leading".

The UK's salt reduction programme has provided the basis of the approach for the recently implemented sugar reduction programme (18,47,49). However, sugar reduction is more complex than salt reduction. Therefore, the programme required a number of different approaches in addition to the main factors that ensured the success of the salt reduction programme. These include:

- developing 3 mechanisms for action - portion size reduction, and the shift of consumer purchasing towards lower or no added sugar alternative products, in addition to product reformulation to lower sugar levels in products
- setting guidelines for sugar levels per 100g of food and calorie or portion size guidelines for each category included in the programme
- taking account of naturally occurring sugars where appropriate (there was no distinction between naturally occurring and added sodium/salt in the salt reduction programme)

The sugar and salt reduction programmes both focus on everyday, popular foods and not on healthier options as these tend to have limited appeal to shoppers and therefore little or no effect on the populations overall diet.

The programme is not confined to targeting foods specifically marketed at or produced for children as analysis shows that in reality adults and children consume the same products. In addition, children aged up to 18 years are included within the scope of the programme.

Portion size

A Cochrane review and meta-analysis found people consistently consumed more food and drinks when offered larger-sized portions, packages or items of tableware (eg plates) than when offered smaller-sized versions. Increasing portion sizes results in more calories being consumed and the review estimated that eliminating larger-sized portions from the diet completely could reduce energy intake by up to 16% among UK adults(50). Successful action has already been taken by a number of businesses to reduce the portion size of their products – for example many chocolate bars, and some single portion ice creams, now contain fewer than 250 kcals. Action in this area is likely to result in overall improvements in population dietary intakes.

Reducing portion size is an important mechanism for action that has been a part of the sugar reduction programme. Evidence suggests that, if also included in a calorie reduction programme, changes to portion size are likely to result in overall improvements in population dietary intakes, including a reduction in calories consumed.

Monitoring

The salt reduction programme was regularly monitored, allowing progress by individual businesses, and in individual food products as well as across food categories, to be reviewed. The sugar reduction programme is also being transparently and regularly monitored with publication of a detailed progress report each year, starting in 2018. This was set out in ‘Childhood obesity: A plan for action’ as it will enable government and other stakeholders to determine progress. It also supports an even playing field as the progress of different sectors of the food industry as well as individual businesses will be apparent. As well as reproducing the baseline data for each product category, annual reporting will include progress by individual businesses and in top selling products within each category covered by the programme.

Summary

The information presented in this report shows that reformulation programmes can reduce people’s intakes of the nutrients that contribute to poor diet and diet-related ill health. It also shows that the structure and ways of working in existing reformulation programmes can be revised and changed to work differently and more appropriately for different nutrients. It highlights that even in their infancy, these types of reduction programmes can be effective in securing changes in the biggest selling products. Taken together this evidence suggests that implementing a similarly structured and monitored programme of product reformulation and portion size reduction could be a successful way of changing the population’s calorie intake. This would need to focus on the foods that contribute significantly to intakes, including the seemingly universal large portion sizes that remain in retail and out of home settings.

Public perceptions and attitudes to calories

In considering the evidence around the need to implement a calorie reduction programme, it is important to consider people's understanding and attitudes towards calories as well as the actions that could be taken to reduce excess intakes. This has been achieved by reviewing existing survey data and by conducting specific research.

The British Social Attitudes (BSA) survey included questions on people's perceptions and understanding of obesity (18). Nearly three-quarters (72%) of respondents agreed that most people who are overweight have put on weight because they eat too much and because they exercise too little. A greater proportion (86%) agreed that both eating a healthier diet and doing more physical activity are equally important actions for someone who is trying to lose weight. The BSA also showed that while those with lower levels of educational attainment are less likely to recognise some of the health risks associated with being obese, they are just as likely as those with other levels of education to identify diet and exercise as the principal factors contributing to being overweight.

Results from a separate online survey (see appendix 4), conducted by PHE for this report, showed that around two-thirds (65%) of respondents were concerned in ensuring they and their family eat a healthy diet; and that over three-quarters (79%) felt knowledgeable about healthy eating. However, whilst almost everyone had heard of calories, less than half of women (39%) and only a quarter of men (24%) knew how many they should be having each day (2000 and 2500 calories per day respectively). When asked on average, each sex estimated a recommended level of intake that was around 90% of the actual recommendations.

Over half of respondents (55%) considered themselves overweight but just under half (45%) thought they were consuming too many calories. In addition, over one-quarter (29%) who identified themselves as being overweight said they were not concerned about the amount of calories they consumed.

The survey showed that there is confusion about how many calories children should have. In absolute terms, younger children should have fewer calories than adults. However, just under a half (44%) of adults reported that children aged 0-5 years and 6-10 years should have the same number of, or more calories, than an adult of the same sex.

In terms of action to support people, respondents agreed that the following were good ways to help people manage their calorie intake:

- personal responsibility eg eating smaller portions, eating more vegetables, doing more exercise and calorie counting
- actions that could be taken by the food industry including price promotions on healthy rather than unhealthy food, clearer information on calories on food labels and menus, offering low calorie options and a wider choice of healthy and low calorie snacks, doing more to take fat and sugar out of food

The majority of respondents (82%) agreed with the statement that government should be encouraging manufacturers to develop products with fewer calories. Results from the BSA survey found that, when asked who was responsible for trying to reduce obesity, 54% of respondents agreed that food manufacturers are responsible and around a third of respondents attribute responsibility to supermarkets (37%), the media (36%) or to government (33%). Results from the same survey also found that around half of respondents (49%) were in favour of reducing the standard size of unhealthy snacks or drinks (eg chocolate bars, fizzy drinks) to reduce rates of overweight and obesity by discouraging over consumption of these foods.

Summary

Collectively, this evidence suggests that people's knowledge of calories is limited and that consumers think that there should be action taken by individuals, government and the food industry to make commonly purchased, everyday foods, healthier by default. The evidence presented here indicates that the best opportunity for government action around calories is the introduction of a broad, structured and transparently monitored calorie reduction programme in everyday food and drink products, combined with reductions in portion size. It also suggests action should be taken by industry to achieve a reduction along with other measures – there is no simple or single solution to tackling childhood obesity.

Developing the calorie reduction programme

In developing the calorie reduction programme, PHE considered information and data from a range of sources. This included:

- analysing data from the National Diet and Nutrition Survey and Kantar Worldpanel to determine which food categories outside the sugar reduction programme were providing most calories to the diet of children up to the age of 18 years
- using insights and intelligence to identify which food categories could be reformulated or portion sizes reduced and what level of reformulation was feasible and practical (typical timeframes for product recipe changes, production and stock turn over were also considered)

PHE's thinking on the programme was tested in a series of meetings. This initial phase of engagement with 21 industry businesses, and 1 non-governmental organisation (NGO) representing over 40 public health organisations, facilitated discussions on the ambition and timeline for the programme and provided a number of points for PHE to consider further. The businesses included covered all sectors of the food industry with a particular focus on the eating out of home sector and were chosen based on market share.

A summary of the points discussed, and a list of the businesses PHE held meetings with, is provided at appendix 5.

An economic analysis was undertaken to model the level of calorie reduction across food groups required to address excess intakes in children. This tested a number of different possible ambitions for the programme. This modelling work also provided estimates of benefits of implementing a calorie reduction programme in terms of premature deaths prevented and savings to NHS healthcare costs and additional savings to social care costs.

The calorie reduction programme aims to reduce excess calorie intakes and to contribute to reducing excess weight and obesity in children and families. It therefore applies to the majority of the population. We have, however, considered the potentially negative impact of calorie reduction measures on the general population and limited number of vulnerable groups (children (0-18 years), low weight adults (Body Mass Index (BMI) <18.5) and older adults aged 75 years and over). Data indicate that the prevalence of calorie-related under-nutrition is low in the UK(51, 52). In addition, the calorie reduction programme is not intended to encourage significant energy restrictions that could result in adverse health outcomes in children or any other group of the population.

It is aimed at moving energy intakes of the general population more towards current UK dietary recommendations through reductions in calories, either through reformulation or reduction in portion size, in mainly high calorie foods. It is therefore anticipated that the intended approach to calorie reduction would present a low risk of significant undernutrition in the general population.

Estimated health economic benefits of a calorie reduction programme

When implementing a new policy or programme it is important to consider the wider benefits and impacts it may have. Therefore, theoretical modelling has been undertaken to estimate the potential impacts of a calorie reduction programme. These are assumed to relate to potential health benefits, illustrated here through a reduction in premature deaths, as well as reduced NHS healthcare costs and reduced social care costs.

A number of different foods are included within the modelling – these are set out in Table 1 below. For these foods it was assumed that calories per portion would be reduced through product reformulation and/or portion size reduction.

Table 1: Foods included within the modelling

Breads with additions (eg ciabatta with olives)	Crisps and savoury snacks	Savoury biscuits and crackers	Meat alternatives
Potato products	Sausages and burgers	Cooking sauces and pastes	Pizza
Table sauces and dressings	Pasta, rice and noodles	Ready meals	Prepared dips and composite salads
Processed fish	Processed poultry	Processed red meat and pork	Egg products
Pies	Food to go		

A number of different potential ambitions were modelled for the foods included – these were 5%, 10%, 20% and 30% calorie reduction due to reformulation. Table 2 outlines the potential outcomes of achieving a 20% reduction in calories in the relevant foods. These outcomes are based on achieving this ambition within 5 years and are spread over a 25 year period.

The 20% figure was chosen because it represented the figure that would likely be chosen for the calorie reduction programme. This decision was made through consideration of the feasibility insights from the salt and sugar reduction programmes, the soundings from food industry businesses and others on potential action around calories and the level of excess calories consumed by children. The model is relatively conservative and the figures presented below are therefore likely to be an underestimate for that reason. Details of the structure of the modelling, and the assumptions made including the health conditions covered, are included at appendix 5.

Table 2: Cost savings and premature deaths avoided from 20% reduction in calories achieved in 5 years with benefits accrued over 25 years

Benefits accrued over 25 years	20% reduction
Premature deaths prevented	35,370
NHS healthcare cost savings (£m)	4,540
Social care cost savings (£m)	4,480

Table 3 gives details of estimated daily calorie reductions, split by age and sex. These figures are calculated assuming a 20% reformulation for the relevant foods included in the modelling. The estimated average number of calories reduced for the whole population is approximately 68 calories per day. Small reductions in calorie intakes, sustained over time, can help to address the significant incidence of overweight and obesity.

Table 3: Number of daily calories (kcals) reduced for each age-sex group under a 20% reformulation ambition

		Calories reduced through 20% reduction (kcals)	
		Male	Female
Age Group	4-10 years	60	59
	11-18 years	87	77
	19-64 years	83	52

The calorie reduction programme

The evidence presented within this document shows that there is a clear case for taking action to reduce the amount of calories that people consume. At the root of this is the fact that children and adults are consuming more calories than they require for a healthy body weight and that is leading to excess weight gain and obesity.

The calorie reduction programme challenges the food industry to achieve a 20% reduction in calories by 2024 in product categories that contribute significantly to children's calorie intakes and where there is scope for substantial reformulation and/or portion size reduction. This requires work to be undertaken by retailers and manufacturers, restaurants, pubs, cafes, takeaway and delivery services and others in the eating out of home sector. The products covered by the programme include ready meals, pizzas, meat products, savoury snack products, sauces and dressings, prepared sandwiches, composite salads and other "on the go" foods including meal deals. More detail is given in appendix 7. It does not cover foods included in the sugar reduction programme. Shifting consumer purchasing towards lower calorie options would be an additional mechanism for action for these products.

The baseline for the programme will be the 52 weeks ending September 2017.

The ambitions for the programme were informed by considering a number of factors. This includes:

- building on the success of, and taking learnings from, the salt and sugar reduction programmes
- soundings from food industry businesses and others on potential action around calories
- the level of excess calories consumed daily by children and the action needed to address this
- the potential economic benefits in the implementation of such a work programme.

Taking action to reduce calories in the foods included in the programme will incorporate foods providing an additional 19% of the calories consumed by children into the reduction and reformulation programme. Together with the sugar reduction programme (25%) and drinks (5% which includes those subject to the soft drinks industry levy (2%) and those drinks covered by PHE's separate programme (3%) – fruit and vegetable juices and milk-based drinks), this will broadly account for 50% of children's overall calorie intakes.

The programme will take an approach based on sales weighted averages, meaning it will focus on the top selling, everyday products that most people buy, most of the time and the businesses that make them. These foods make the largest contributions to

calorie intakes and it is paramount that industry focuses its reformulation efforts on these products and not on specific, lower calorie options which generally make up only a small proportion of sales. The sales weighted average approach means that businesses can include products above the forthcoming guidelines as long as their overall sales weighted average declines.

The programme covers all children aged up to 18 years and is therefore targeting all foods, not just those specifically marketed at or produced for children, particularly as analysis shows that in reality children and adults consume the same products. By working in this way the programme will provide wider benefits to all consumers including those in lower socio-economic groups where obesity rates in children are higher. We will also seek to gather evidence of the impact of the programme across all economic and geographic groups.

The eating out of home sector collectively contributes 20-25% of an adult's energy intakes (20). It is therefore essential that this sector as a whole engages as fully as retailers and manufacturers with the reduction and reformulation programme to ensure both a level playing field and that excess calorie intakes are successfully tackled.

The UK nations recognise the need to focus on calories and the purpose of a calorie reduction programme. There has been strong support from them to date for the existing sugar reduction and reformulation programme. PHE will continue to involve the UK nations closely in the further development of the calorie reduction programme and forthcoming guidance to industry.

Next steps

Businesses are encouraged to start work now to reduce the calorie content of everyday foods included in the calorie reduction programme. They are guided toward focusing on their top selling products and not just on healthy options. PHE will support their efforts by setting guidelines for products; establishing baseline calorie levels in food categories; and regularly reporting progress across the different sectors, food categories and for the top contributing businesses and products.

PHE will start working towards setting specific guidelines for the product categories included in the programme from April 2018. It is envisaged that guidelines will be set as sales weighted averages in terms of calories per 100g of product as well as calorie or portion size guidelines for products likely to be consumed by an individual at one time. These are both likely to be set across broad product categories as has been done for the sugar reduction programme.

The aim is to publish the guidelines mid-2019 alongside a detailed analysis of baseline levels of calories in different food categories for different sectors of the food industry in

the baseline year ending August 2017. The timeline for this is included at appendix 8. This will include substantial engagement with stakeholders over the coming months, including continuing our specific programme of engagement with the eating out of home sector. It is also important that smaller businesses play their part and additional guidance will be provided for them as the programme develops.

When setting guidelines for portion sizes PHE will need to be careful that these do not take people beyond a “tipping point” where they consume 2 products instead of 1, or substitute the “missing” calories with other foods meaning that on balance they consume more calories in total. It may be necessary for businesses to reduce portion sizes gradually to help mitigate these potential unintended consequences. The 20% reduction ambition and timeline for action takes account of this.

There are foods that are common in the diet that are not covered by either part of the programme detailed above and that are also not covered by the sugar reduction programme. This includes foods like bread, baked beans and stocks and gravies where it may be more beneficial to public health to focus on nutrients other than calories. We will consider separately the best approach to take on these foods.

It may also be necessary to consider setting separate guidelines for the eating out of home, takeaway and meal delivery sectors. It may make sense to set guidelines across menus for this sector rather than for specific items but at the same level of ambition to that set for individual product categories.

There are other foods in which it is not possible to make any change or reduction such as unprocessed fruit and vegetables, unprocessed meats etc. These are therefore excluded from the programme.

Appendix 9 sets out where different categories of food and drinks are included within the calorie, sugar and salt reduction programmes, as well as products within the soft drinks industry levy and PHE’s separate programme on drinks. Most products are included in the salt reduction programme with some exceptions for some products included in the sugar reduction work. They may also fall within either the sugar or calorie reduction programmes; no products are included in both of these.

Progress will be reviewed transparently and regularly against the 2017 baseline. This will include assessing progress across all categories and for all 3 mechanisms for action and using the same data, and similar analyses and metrics, as those being used for the sugar reduction work. PHE will work to develop, in discussion with stakeholders, the metrics and analyses that will be used to monitor the programme at the same time that the guidelines are developed. This information will be used to determine whether sufficient progress is being made over all as well as by different sectors of the food industry and by individual companies.

Areas not covered by calorie reduction programme

In setting out the scope of the calorie reduction programme it is also important to set the parameters for what the programme does not cover. The programme will not set specific menu plans or eating pattern guidance. There are other sources for this information including:

- 5 A DAY portion sizes (54)
- The Eatwell Guide (9)
- Early years menus (55)
- Change4Life (33)

Finally, while alcohol contributes significantly to calorie intakes in adults(41), and the programme includes children up to 18 years old and alcohol is likely to contribute to calorie intakes in the oldest of these children, alcohol is considered to be outside the remit of the reduction and reformulation programme and therefore will not feature. PHE will continue to communicate messages about safe consumption and the benefits of reducing alcohol consumption separately.

Conclusions

There is a clear case for taking action to reduce people's daily consumption of calories. The analysis and modelling carried out for this report show that, at a population level, children and adults are consuming excess calories on a daily basis. The report shows that the benefits of reducing this excess consumption, both in terms of preventing premature deaths and saving NHS healthcare costs and social care costs, are substantial. Consumer surveys also show that people believe that the government should be taking action to encourage the food industry to develop products with fewer calories.

The salt reformulation programme has significantly reduced levels of salt in foods and consumption of salt by individuals. We have also begun to see action by businesses on sugar reduction. The evidence suggests that a similarly structured programme delivering an ambitious reduction in calories would also bring benefits to the population.

Although the calorie reduction programme will devise guidelines for foods consumed by children, adults generally eat the same foods. The programme will help all family members to reduce calorie consumption, reducing the risk of weight gain and the consequences of this to health. It will also help to reduce health inequalities, as levels of childhood obesity, tend to be the highest in the most deprived.

Like the salt and the sugar reduction programme, the intention is that as a result of the calorie reduction programme the healthier choice becomes the default choice for families. It will work behind the scenes with the food industry to slowly improve the calorie and wider nutrient content of everyday foods without families having to proactively make burdensome changes. However, willingness to accept change is important. If more shoppers were to look for and choose healthier products it could strengthen success and also increase industry confidence and boost innovation. PHE will therefore continue to support healthy eating through the Change4Life and One You social marketing programmes.

PHE will now undertake work to further define the food categories to be included in the programme with baseline analysis for each of these to assist businesses. This will inform proposed category guidelines which will be subject to comprehensive engagement and consultation with all sectors of industry and other stakeholders later in 2018. It is currently anticipated that the industry guidelines will be published mid-2019 alongside baseline levels of calories in the food categories included in the programme for the year ending August 2017. Businesses are also expected to continue working towards guidelines that already form part of the reduction and

reformulation programme. PHE will also closely monitor progress by businesses and produce detailed reports annually from 2020. PHE will advise government if progress is not being made.

‘Childhood obesity: A plan for action’ set out the government’s commitment to tackling the issue. The reduction and reformulation programme, and the calorie reduction work specifically, is a key intervention that can contribute to reducing the incidence of childhood obesity. If the ambitions set out here are achieved this will provide clear benefits – but any significant progress to reduce calorie intakes will yield improvements and contribute to addressing the current obesity epidemic and its effects on the health and wellbeing of children and their families.

Acknowledgements

PHE would like to thank all those whose engagement has helped in the preparation of this document, particularly:

Professor Joe Millward and the other peer reviewers for their work on the excess calories assessment.

The businesses across all sectors of the food industry, and non-governmental organisation, for their engagement and contributions to the development of the calorie reduction programme in November and December 2017.

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Appendices

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Appendix 1: Energy intake requirements

Energy requirements can be calculated from measurements of habitual total energy expenditure (TEE). Energy balance is achieved when energy intake is equal to TEE over a period of time. In the absence of childhood growth, pregnancy or breastfeeding, TEE is the sum of daily energy used to maintain the basic functioning of the body (basal metabolic rate or BMR: metabolism at rest) and the energy expended in physical activity. TEE and the energy required to maintain body weight can therefore be expressed as a multiple of BMR, the physical activity level (PAL):

TEE* = BMR x PAL

*** where TEE is used as an indicator of energy requirements/intake**

In 1991, the Committee on Medical Aspects of Food and Nutrition Policy (COMA) estimated the energy requirements of the UK population (dietary reference values or DRVs for energy) at levels that would maintain body weights at that time, that is, energy intakes that would match energy expenditure(1). The DRVs for energy are defined as the Estimated Average Requirements (EAR). The Estimated Average Requirement (EAR) is an estimate of the average requirement for energy or a nutrient and assumes normal distribution of variability.

The EAR is set as an average so about half of a defined population will usually need more than the EAR, and half less.

Around 2 decades later, the Scientific Advisory Committee on Nutrition (SACN) was asked to review energy requirements for the UK population, as substantial new evidence had become available(2). Over the same period, the prevalence of overweight and obesity in all age groups of the UK population had increased significantly. Using the method employed by COMA and calculating values to match energy expenditure, would, for many of the population, result in maintaining overweight and would not be consistent with long-term good health. In recognition of this, SACN therefore adopted a prescriptive approach in calculating energy requirements. Therefore, the revised energy requirements for all population groups (with the exception of pregnant women), detailed in SACN's report 'Dietary Reference Values for Energy' (2011), were set at levels of energy intake required to maintain a healthy body weight for otherwise healthy people at what were then current levels of physical activity.

In adults, the healthy body weight range is generally defined as being equivalent to a body mass index (BMI) between 18.5 – 24.9 kg/m^2. However, for the purposes of calculating the estimated average requirements for energy, SACN used the heights of

the adult population to identify healthy body weights associated with a BMI of 22.5 kg/m^2 – this is the BMI level associated with a minimum risk of mortality and can be considered to represent a healthy body weight. These data were used to calculate BMR values that could then be used in the calculation of TEE. PAL was estimated from doubly labelled water (DLW) reference data sets. The DLW method is the gold standard for measuring TEE in in free living people over 1 or 2 weeks. When body weight is stable TEE is equal to energy intake.

Estimating energy requirements based on intakes to maintain a healthy body weight means that for those groups of the population that are overweight, eating in accordance with SACN's recommendations will assist weight loss and a move towards being a more healthy weight. Similarly, if those who are underweight follow the recommendations they are to gain weight and move towards a healthy weight.

The revised SACN energy requirements for men and women are slightly higher than previously recommended by COMA. This does not mean that people have become more active or that they should eat more, instead SACN's revised energy requirement values represent a better estimation of energy needs at current activity levels based on evidence that is more robust.

For children over 1 year of age, the PAL values are those calculated directly from a data set of published DLW studies which were aggregated on the basis of study mean values. Estimates of the likely increase in TEE associated with growth and varying increases in activity level are also given. For ages 1-4 years, BMR was calculated based on the 50^{th} centile of weights from the UK/WHO Child Growth Standards and for ages 5-18 years they are based on the UK 1990 reference for children and adolescents. The overall pattern of differences from the old COMA 1991 values is for lower values from 3 months to 10 years and higher values for adolescents.

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Appendix 2: Under reporting in the National Diet and Nutrition Survey

Reported energy intakes in the National Diet and Nutrition Survey (NDNS) are below the SACN estimated average requirements (EAR) in all age/ sex groups except for children aged under ten years(1,2). This is due to the underreporting of energy intakes by survey participants in NDNS(3). Misreporting in self-reported dietary methods is a well-documented issue(4). Underreporting may result from a number or combination of behaviours, for example omitting to record foods or drinks consumed, whether intentionally or otherwise, underestimating quantities consumed, or changing usual consumption as a result of being asked to record diet(3). Changing eating patterns towards more eating out and snacking may also mean that survey participants tend to underreport to a greater extent now than they did in the past, although the evidence around this is limited.

Underreporting of food intake is particularly pronounced in the overweight and obese (5). Thus, the proportion of the population likely to under-report increases as the population gains weight, thus exacerbating the problem of underreporting of energy intakes (6,7).

Studies using the doubly labelled water technique (DLW) enable estimations of under reporting to be made. A DLW study using a subsample of NDNS participants showed that energy expenditure is substantially higher than reported energy intake for the majority of participants – reported energy intake in adults was on average 34% lower than energy expenditure measured by DLW – although there was a wide variation between individuals and the subsample was small(1, 3).

Doubly labelled water is the most accurate method available of assessing energy expenditure in free living people over 1 or 2 weeks. As energy expenditure is equal to energy intake when body weights are stable DLW studies are used to indicate the extent to which reported energy intake is likely to reflect usual energy intake. It does not give any information about relative underreporting of different nutrients or foods. The doubly labelled water study is carried out on a small subset of the NDNS sample and the assessment is not concurrent with the dietary intake. For these reasons it has not been considered appropriate to correct reported energy intakes using the DLW data.

The NDNS uses the best methods available to capture as complete and accurate picture of food consumption as possible. However, there are considerable challenges in collecting robust dietary intake data and underreporting has been well recognised for

many years in dietary surveys world-wide, not only in NDNS. PHE work closely with the consortium that is contracted to run the NDNS on its behalf – led by NatCen Social Research, working closely with scientists at the MRC Epidemiology Unit at the University of Cambridge (previously the MRC Elsie Widdowson laboratory) – to ensure the methods used for collecting dietary data are the best available. They also work to make sure that the methods used are designed to capture as complete and accurate a picture as possible of food consumption so that the data collected are robust and provide a sound basis for PHE's work. Dietary data collection methods for the NDNS are currently under review with this in mind.

PHE considers that while underreporting can be mitigated by the use of the best methods it cannot be eliminated and will always be an issue in self-reported dietary assessments. In spite of the prevalence of underreporting, these surveys provide valuable and robust data to assess the diet and nutrient intakes of population sub-groups, although the existence of underreporting means that care is needed in the detailed interpretation of data.

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Appendix 3: Estimating energy intakes for children and adults

This appendix describes the approach used by Public Health England (PHE) to estimate levels of total and excess energy intakes in subgroups of the UK population (overweight and obese children aged 4-18 years and all adults aged 19 years or over).

PHE was assisted by Professor Joe Millward (Surrey University) in preparing this appendix. It was also peer reviewed by 2 members of the Scientific Advisory Committee on Nutrition's Maternal and Child Subgroup.

Background

Excess weight gain occurs when, over time, average energy intake (EI) from food and drink exceeds energy requirements for maintaining essential body functions (this is the basal metabolic rate or BMR) and energy used in physical activity, and for children physiological energy needs for normal growth. This also includes the thermic effect of feeding (the energy required to digest food). In this situation, excess food energy is stored in body tissues, mainly as fat.

For adults, total energy expenditure (TEE) is the sum of the energy used to maintain BMR and physical activity (plus other components such as the energy required to digest food and for women the metabolic costs of pregnancy and lactation). TEE for children also includes the energy used for growth. In energy balance, TEE can be assumed to equal energy intake (EI), plus any additional needs, such as growth. In turn, TEE or EI can be used as an estimate of energy requirements:

TEE (EI) = BMR x PHYSICAL ACTIVITY LEVEL (PAL)

Basal metabolic rate (BMR) is a function of body size; it is dependent on height and weight - larger individuals require more energy to maintain their body functions. Obese and overweight adults and children require a higher daily energy intake to maintain their body weights than do lean people of the same age and height and with similar activity levels.

As the prevalence of overweight and obesity in adults and children living in England is high (6, 7) it is evident that energy intakes for many of the population are habitually in excess of energy requirements for a healthy body weight.

In theory, levels of energy intake should be measurable in dietary surveys. In practice, however, underreporting of energy intake is an issue in dietary surveys. The problem is

particularly pronounced in individuals who are obese who tend to underreport food consumption and therefore energy intake more than lean individuals (see Appendix 2). As self-reported energy intakes are likely to be underreported, an alternative, more accurate and reliable, method needs to be used to estimate habitual energy intakes in the population.

In 2011, the Scientific Advisory Committee on Nutrition (SACN) published revised dietary reference values for energy for all age groups (SACN is an independent committee of scientists providing advice on nutrition, diet and health to UK governments). SACN used estimates of TEE as a marker of energy intakes to calculate energy requirements for the UK population. The approach employed by SACN in its report 'Dietary Reference Values for Food Energy' is described below (8).

The aim of this appendix is to determine the magnitude of the difference between habitual excess energy intakes in overweight and obese children and recommended energy requirements estimated to support normal growth and maintain healthy body weights. Levels of excess energy intake are also calculated for adults.

Dietary reference values for energy

The Dietary Reference Values (DRVs) for energy provide the best estimates of the food energy needs of the UK population and its subgroups. SACN defined DRVs for energy as Estimated Average Requirements (EARs), which for infants and children are the levels of energy intakes required to meet energy expenditure and the additional needs for healthy growth and development(9). SACN took a prescriptive approach to defining energy requirements (EARs) and rather than calculating values to match energy expenditure, which for many children would maintain overweight, the energy requirements were set at levels of energy intake required to maintain a healthy body weight and support normal growth.

This means that the habitual energy intakes of overweight or obese children exceed the estimated energy requirements (EARs) that have been calculated for a healthy body weight. If overweight/obese children were to eat at the EAR energy intake level this would result in lower energy intakes, leading to change towards a healthier body weight.

For this assessment, heights and weights were taken from the Health Survey for England and were used in predictive equations to estimate the basal metabolic rate (BMR). This is based on the methodology used by SACN to estimate EARs (8).

The SACN factorial model for EAR values for energy

In summary, SACN's approach to estimating EARs was to assume the energy balance principle in which, over time, EI is equal to TEE plus any special needs such as the energy deposited as growth. TEE is the sum of all daily energy expenditure, BMR, energy expenditure at rest in the post absorptive state (for which suitable prediction equations exist for children and adults of all ages based on body weight and heights), the metabolic cost of growth, and the energy expended in physical activity.

EI, the energy required to maintain normal body weight at any energy expenditure can therefore be assumed the same as TEE, and this can be expressed as BMR multiplied by the physical activity level (PAL):

EI = TEE = BMR x PAL

For children, the energy intake required to allow new tissue deposition must also be taken into account. SACN assumed that an additional 1% of the PAL value is sufficient to allow for the energy deposited in the tissues during growth for each age group. EAR values for the UK population and its subgroups were based on these factorial calculations of an EI at healthy body weights, which were identified by the median BMI values in reference growth data for children, or a healthy BMI of 22.5kg/m^2 for adults.

DLW data used to estimate population TEE and PAL values

SACN used data derived from studies of TEE that used the doubly labelled water (DLW) method, which allows estimates of TEE in free living individuals over a period of 1 or more weeks(9). From these data, SACN estimated PAL values for different population subgroups.

For children and adolescents aged from 1-18 years, PAL values were derived from a large number (n=170) of DLW studies of TEE in groups of children. For each of these studies, mean PAL values were calculated as TEE/BMR, either from reported BMR values or from predicted BMR. The Henry Oxford equations based on weight and height, were adopted as suitable BMR prediction equations in which the coefficients and constant vary by age and gender. If height was not reported the BMR prediction equation was based only on weight.

BMR = weight coefficient x weight (kg) + height coefficient x height (m) + constant

PAL values were grouped for ages 1-3, 3-10 and 10-18. No gender differences were identified. Median values for PAL were calculated for each of these 3 groups, adjusted to allow for normal growth, and used as the population reference PAL values for all boys and girls of those age groups, ie 1.40, 1.58 and 1.75 for ages 1-3, 3-10 and 10-18.

For adults a DLW dataset of measures of TEE in populations thought to be representative of the current UK population was identified as a suitable reference population. This was derived from 2 large and similar datasets of individual TEE values, obtained from the USA - the OPEN and Beltsville studies. These were combined as a single data set and PAL values were derived by dividing TEE by the measured or predicted BMR for the appropriate gender and age group. No effect of gender or age were observed for the PAL values so a single PAL value, the population median of 1.63, was used as the population reference value for all adult men and women.

Reference standards for "ideal" and "healthy" body weight

For children, weights equivalent to a BMI calculated from weights and heights on the 50th centile of the UK/WHO Child Growth Standards for ages 1-4 years, and of the UK 1990 reference data for ages 5-18 years were adopted as the definition of an "ideal" body weight. For adults, a weight equivalent to a Body Mass Index (BMI) of 22.5kg/m^2 at reported heights was adopted as an "ideal" body weight.

A "healthy" body weight was defined differently and allows for a heavier weight than an "ideal" weight. For children, a "healthy" body weight was defined as being below the 85th centile of the standards listed above. For adults, a "healthy" body weight was a weight equivalent to a Body Mass Index of 25kg/m^2 at reported heights.

Excess energy intakes

For overweight populations of children and adults excess EI defined here is calculated as the difference between EAR values and the predicted current habitual EI: ie

Excess EI = predicted current EI-EAR

Predicted EI is calculated in the same way as the EAR described above except that BMR is calculated at actual rather than prescribed weights and heights. Excess energy intakes in children have been estimated for 3 different age bands: primary school aged children, (4 to 10 year olds), secondary school aged children, (11 to 15 year olds) and adolescents of school leaving age, (16 to 18 year olds). Estimates have also been carried out for UK adults in 3 different age bands: 19 to 30 years, 31 to 60 years, and 61+ years. Infants and preschool children have not been included in these calculations.

Aims

For children

Use HSE data (3 years combined: 2012 to 2014), UK1990 reference data and SACN population EARs to:

- compare current height and weight data with UK1990 data
- estimate the proportion of overweight and obese children in each age group by gender and the excess weight in kilograms of these children
- predict energy intakes by the factorial model for overweight and obese children in each age group by gender, compare these with EARs for energy and calculate excess energy intakes.

For adults

Use HSE data (3 years combined: 2012 to 2014) and SACN population EARs to:

- estimate the proportion of overweight and obese adults in each age group by gender and the excess weight in kilograms of these adults
- predict energy intakes by the factorial model for overweight and obese adults in each age group by gender, compare these with EARs for energy and estimate average excess energy intakes

Methodology

Proportion of overweight and obese children

Three years of HSE data - 2012 to 2014 - were combined to estimate the proportion of overweight and obese children in the population by age group. Each child aged 4 to 18 years was classified according to their BMI to the corresponding BMI centile of the UK1990 reference data using their age at last birthday (which was matched to the corresponding BMI centile assuming a mid-year age for each respondent). The reference dataset was downloaded as part of the LMS growth tool(10) and includes values that summarise the distribution of BMI at each age: median (M), coefficient of variation (S), and a measure of skewness (L)(11).

PHE used the LMS method (11): the BMI, and L, M and S values corresponding to the mid-year age for each child in the equation below. This normalises the skewed distribution of reference BMI values and calculates a z-score (number of standard deviations from the mean):

$$\text{z-score} = \frac{[\text{BMI}/\text{M}(t)]^{\text{L}(t)} - 1}{\text{L}(t)\,\text{S}(t)}$$

The BMI z-score for each respondent was then converted to their BMI centile.

The threshold for published overweight figures for children that use HSE and NCMP data is the 85th BMI centile(12). Therefore the children were split into those with a reference BMI centile ≥85 (overweight and obese) and those with a reference BMI centile <85 (not overweight or obese) to estimate the weighted proportion of overweight and obese children in each age and gender group.

Estimating excess weight in children

Excess weights of overweight and obese children were compared with being on the cusp of having a healthy weight (corresponding to the 85th reference BMI centile), and with being an ideal weight (corresponding to the 50th reference BMI centile). First, BMI values corresponding to the 85th and to the 50th reference BMI centiles were calculated at each mid-year age by gender using a rearrangement of the above LMS equation:

BMI = M (1+L*S*zα) ^1/L

The z-scores that correspond to the 85th (α = 0.85) and 50th (α = 0.50) centiles are 1.0364 and 0.0000, respectively.

In this way, 2 BMI values were constructed that corresponded to the 85th and to the 50th reference BMI centile for each mid-year age and gender of each respondent. These BMI values were used to create 2 new variables:

1. the difference in BMI to the healthy/overweight threshold for each respondent
2. the difference in BMI to being an ideal weight.

From these differences in BMI and the heights of the respondents, the excess kilograms each group were carrying was estimated:

Excess weight = BMI difference x height(m)^2

For children classified as overweight and obese the median values for excess weight above a healthy weight and to being an ideal weight were calculated for each age and gender group.

Children's current EIs

Habitual EIs for children were calculated across all BMI centiles with the factorial model described above in which EI is predicted as TEE = BMR x PAL. BMR values for the UK child population were predicted from the Henry equations at the appropriate current weights and heights. Population reference PAL values for each age group were assumed to be the same as those used by SACN to derive the EAR values. These derived TEE values were assumed to be proxy values for current energy intakes required to maintain current rates of growth and body weights.

As not all children are overweight, values for energy intakes were also predicted for overweight and obese children by age band and gender. Median height and weight values for each age at last birthday were taken from the HSE 2012-14 data for each gender. Median averages were taken across these values for each age and gender group to use with the Henry BMR prediction equations.

EARs for children for comparison with current EIs

EARs were calculated for children by age band and gender using the factorial model in which BMR is calculated by the Henry equations for healthy body weights at current (HSE) heights. These body weights were calculated for current heights with reference BMI values which were derived from median average heights and weights at each mid-year age and gender of the reference, (UK1990), data. Mid-year age values for each group was comparable with the HSE height data that records each respondent's age at last birthday, assuming that respondents birthdays are distributed evenly throughout the year at each age. Excess energy intakes were calculated for each group of overweight children as the differences between these EARs and current EIs.

Changes in children's height and weight data since 1990

The Wilcoxon test was used to test for differences between children's height and weight data from HSE 2012-2014 and the UK1990 reference data. As median values from the HSE data were tested against a single reference median test value for each age and gender group, the non-parametric Wilcoxon method was used. To test whether the heights of the overweight and obese group differed from the non-overweight group a two-tailed age-paired t-Test was used.

Proportion of overweight and obese adults

HSE respondents aged 19 years and older at last birthday were split by those that were overweight and obese (BMI ≥ 25kg/m^2) and those not overweight or obese (BMI<25kg/m^2). Weighted proportions of overweight and obese adults were estimated by age band (19-30 years, 31-60 years and 61 years and over) and gender.

Estimating excess weight in adults

Two new variables were created: the difference in each adult's BMI to the healthy/overweight threshold (BMI of 25kg/m^2) and the difference in BMI to being an ideal weight (BMI of 22.5kg/m^2). From these differences in BMI and the heights of the respondents, the excess kilograms they were carrying was calculated:

Excess weight = BMI difference x height $(m)^2$

For adults classified as overweight and obese the median value for excess weight above a healthy weight and above an ideal weight was calculated for each age and gender group.

Adult's current EIs

The factorial model of current habitual intakes was used: ie EI = TEE =BMR x PAL. Values were predicted for those with BMI values =<25 (non-overweight), >25 (overweight and obese) and all adults by age band and gender. BMR values were predicted with the Henry equations at median height and weight values (HSE 2012-14) for each age and gender group. The population PAL value of 1.63 was assumed.

EARs for adults for comparison with current EIs

EARs were estimated for non-overweight, overweight and obese, and all adults from the population reference PAL value (1.63) and BMR. BMR was calculated at the mid age range current heights for each weight group and age band and associated healthy body weights: ie equivalent to a BMI of 22.5kg/m^2.

The average value for excess energy intakes was calculated, as EI minus EAR, for all adults and for non-overweight, and overweight and obese adults at each age and gender. SPSS 23 and MS Excel 2013 was used for all analyses.

Results

Table 1. Differences in median weights and heights from HSE 2012-14 data and from the UK 1990 reference data

		Height (cm)				Weight (kg)			
Gender	**Age bands (years)**	**HSE 2012-14**	**UK1990**	**Difference**	**p value[1]**	**HSE 2012-14**	**UK1990**	**Difference**	**p value[1]**
Boys	4-10	125.4	124.9	0.5	ns	25.4	24.3	1.1	<0.0001
	11-15	162.5	158.6	3.9	<0.0001	50.8	46.0	4.8	<0.0001
	16-18	176.2	176.7	-0.5	ns	69.2	65.7	3.5	<0.0001
Girls	4-10	124.2	124.3	-0.2	ns	25.7	24.4	1.3	<0.0001
	11-15	159.0	157.7	1.3	ns	52.5	47.8	4.6	<0.0001
	16-18	163.1	163.5	-0.5	ns	59.6	57.2	2.4	<0.0001

1. Wilcoxon test used to examine differences between values from HSE 2012-14 and UK1990 reference data.

On average, children were heavier in 2012-14 than they were in 1990 with increases in median mid-age range weights for boys and girls of between 1 and 5kg ($p<0.0001$). During this period there was no significant change in heights except in the case of 11 to 15 year old boys, for whom an increase of almost 4cm had occurred ($p<0.0001$). However, heights of the overweight and obese children were slightly greater than the non-obese children overall (as indicated by an age-paired t-test) with differences of 3 and 2cm for boys and girls at 7 years respectively, 3cm for boys at 13 years and 1 cm for girls at 17 years.

Table 2. Excess energy intakes for all children and for overweight or obese children aged 4 to 18 years, as well as their average excess weight (kg) and estimated energy intakes[1] (kcal) by age band, gender and weight status[2]: HSE 2012-2014

		All children			Overweight or obese					
Gender	Age bands (years)	EAR[5]	Energy intake	Excess calorie intake	Proportion overweight or obese	kg to healthy weight[3]	kg to ideal weight[4]	EAR[5]	Energy intake	Excess calorie intake
Boys	4-10	1690	1710	21	26%	2.1	5.4	1724	1871	146
	11-15	2598	2667	69	33%	6.6	14.0	2636	3133	498
	16-18	3128	3232	104	32%	9.1	18.6	3115	3621	505
Girls	4-10	1575	1609	34	25%	2.3	6.0	1603	1760	157
	11-15	2302	2365	63	33%	6.5	13.9	2306	2536	229
	16-18	2455	2499	44	35%	9.2	17.5	2458	2748	291

1. Estimated as BMR X PAL using HSE height and weight data with Henry equations to predict BMR and population reference PAL values (adjusted for growth costs). Excess is the difference between energy intakes and the EAR.
2. Each respondent's BMI has been mapped onto the corresponding centile of the UK1990 growth reference data. The sample was then split into those being equal to or greater than the 85th centile and those less than the 85th centile of BMI.
3. Median excess kilograms to correspond to the 85th UK1990 BMI centile.
4. Median excess kilograms to correspond to the 50th UK1990 BMI centile.
5. Estimated as BMR X PAL with BMR predicted from mid age range of current (HSE) heights and ideal weights, calculated as weights predicted for these heights from mid-year 1990 reference BMI values.

For all children, the excess energy intakes, that is the difference between their EAR values and predicted intakes, ranged across the age groups from 21 to 104kcals/d for boys and 34 to 63kcals for girls. Overweight or obese children accounted for around a quarter of all primary school children and a third of secondary school children. Of these, primary school children had around 2kg excess weight compared with their average healthy weight (corresponding to the 85th reference BMI centile), and 5-6kg excess weight compared to their ideal weight (corresponding to the 50th reference BMI centile for their age and height). The older the age group, the greater the excess weight with up to 19kg for boys and 18kg for girls compared with the 1990 reference data. On average, compared with those with ideal body weights, overweight or obese children consumed excess energy intakes between 146 and 505 kcals per day for boys, and between 157 and 291 kcals per day for girls.

Table 3. Proportion of overweight or obese adults aged 19 - >60 years, their average excess weights (kg) and estimated energy intakes[1] (kcal) by age band, gender and weight status[2]: (HSE 2012-2014)

		All adults			Overweight or obese					
Gender	Age bands (years)	EAR[5]	Energy intake	Excess calorie intake	Proportion overweight or obese	kg to healthy weight[3]	kg to ideal weight[4]	EAR[5]	Energy intake	Excess calorie intake
Men	19-30	2758	2919	161	47%	9.7	17.7	2754	3179	425
	31-60	2626	2911	285	73%	12.0	19.8	2621	3000	379
	>60	2346	2638	292	78%	11.8	19.1	2343	2706	362
Women	19-30	2217	2296	79	43%	10.0	16.6	2203	2500	297
	31-60	2107	2239	133	60%	11.5	18.2	2098	2350	252
	>60	1892	2056	164	68%	11.0	17.3	1885	2136	251

1. Estimated as BMR x PAL with BMR predicted from HSE height and weight data with Henry equations and the population median PAL value (1.63)
2. Sample split into those with a BMI equal to or greater than 25 and those with a BMI of less than 25.
3. Median excess kilograms to correspond to BMI of 25kg/m^2.
4. Median excess kilograms to correspond to BMI of 22.5kg/m^2.
5. Estimated for subjects with a BMI≥25 as the population median PAL value (1.63) x BMR predicted from mid age range of current (HSE) heights and ideal weights equivalent to a BMI of 22.5kg/m^2 at these heights.

The proportion of overweight or obese adults increased across the age bands with 78% of men and 68% of women in the 60 years and over age group being overweight or obese, carrying up to 18-20kg excess weight compared with their ideal weight. On average all adults (men and women combined) consumed 196 excess kcals per day, and overweight and obese adults 323 kcals per day. When examined by age group and gender, overweight and obese men consumed between 362 and 425 extra kcals per day and overweight and obese women consumed between 251 and 297 extra kcals per day, compared with the EAR values calculated for ideal body weights.

Notes and limitations

In the same way that uncertainties exist for the SACN EAR values, the calculations of habitual EI values and excess energy intakes reported here have their limitations.

Use of average historical PALs for each age band

The UK population is characterised by sedentary lifestyles at all ages raising a question of whether the PAL values used to calculate EAR values are appropriate for predicting current habitual EI values. Obtaining quantitative estimates of population activity levels over time is subject to considerable inaccuracy and bias because measures are largely based on self-reported data, observational studies, or indirect measures (eg heart rate monitoring). The development of the doubly labelled water (DLW) method in the 1980s has enabled more accurate measurement of TEE in free-living subjects. DLW data from large-scale surveys in the United States, together with

data from sub-samples of the UK NDNS, does not provide evidence that energy expended by physical activity has declined since the 1980s. However within the reference adult DLW dataset, average PAL values do not diminish with increasing obesity. This most likely reflects the fact that for most types of physical activity the energy cost increases with increasing body weight. Thus as body weight increases, any decrease in physical activity is counterbalanced by the additional energy burned by physical activity, and PAL values may not change. DLW measures of physical activity are poor measures of actual physical activity behaviour when weight gain is occurring. Direct measures of physical activity (eg with accelerometers) show that this is reduced in the obese and that reduced activity predisposes to increased weight gain (3). This means that the population PAL values used here may still be appropriate for a heavier, more sedentary population.

Static weight and normal growth rates assumption

Estimates for excess energy intakes are calculated on the assumption that children are growing at reference growth rates (ie with growth costs accounted for by the additional 1% of the PAL values) and that the overweight and obese adult respondents have static weights and are in energy balance. At least 1 fifth of children begin school overweight or obese, and 1 third go on to secondary school overweight and obese (NCMP). This means that energy intakes for these overweight and obese children are in excess of intakes associated with normal growth rates throughout most of childhood. However within these calculations of current energy intakes, the value for energy deposition at 1% of PAL x BMR means that for any PAL value, in absolute terms the allowance for growth increases as the body weight and consequent BMR increases. Thus the energy intake values for the overweight and obese children in table 1 include an estimate for growth which is greater than that for children of normal weights. Whether such estimates would account for the extra growth which has mediated the excess weight gain is again difficult to judge, not least because it could have been mediated in part by reduced physical activity. Also this calculation takes no account of the fact that after puberty in the adolescents, growth deposition costs may be higher in girls than boys (at least for the same growth rate), because of a higher fat and lower fat free mass (FFM) content. Accepting these caveats these are the best estimates we can currently obtain from current HSE height and weight data that is available.

For adults the assumption of energy balance cannot be true at all times since the process of weight gain requires positive energy balance over periods of time. This means that these values for excess energy intakes may be underestimates.

However, in spite of these limitations, the values are considered more robust than using reported energy intakes from dietary surveys.

EARs across age groups are less precise but more robust

EARs are calculated as a single average across age bands, as this increases the sample size behind each estimate, and takes into account that the coefficients and constants used in the Henry equations have been estimated across bands and are less suitable to use for individual ages. For that reason these should not be used as reference values for energy intake for individual ages within that band but to compare with estimated intakes at current weights and heights. Thus the EAR values in table 2 are calculated at either current overall average heights or at the observed heights of the 85th+ centile.

Differences between boys and girls

The higher excess energy intakes for adolescent boys than girls even though excess weights are not different between sexes (see table 2) reflects the sex differences in the Henry BMR prediction equations for adolescent girls compared with boys. This is a consequence of their different overall body composition with a higher FFM and lower fat mass in males compared with females(4). This means that in adolescent boys compared with girls, with increasing bodyweight, the BMR, TEE and EI increases more per kg excess weight.

British vs England data for comparison

British1990 data was collected for children from across Britain whereas HSE data is for England only. British1990 reference data is considered to be for a population of children with healthy body weights and so should provide a reasonable comparison.

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9. Doubly labelled water (DLW) is water in which both the hydrogen (H) and oxygen (^{16}O) have been partly or completely replaced for tracing purposes (ie *labelled*) with 'heavy', non-radioactive forms of these elements: ^{2}H and ^{18}O. The DLW method measures the rate of disappearance of these 2 tracers given to an individual in water as they are washed out of the body. ^{18}O disappears faster from the body than ^{2}H because it is lost in both urine and as carbon dioxide in breath. ^{2}H is only lost from the body in urine. The difference between how fast ^{2}H and ^{18}O disappear provides a measurement of carbon dioxide production and this can then be converted into the amount of energy used.
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Appendix 4: Online survey to identify perceptions and attitudes around calories

Background and method

This report summarises the findings from an online survey carried out to provide information on the perceptions and attitudes towards calories of a sample of adults in England. Fieldwork was conducted using the Kantar online omnibus service among 1,061 adults aged 16+ in England. Fieldwork was conducted from 21 November until 23 November. The data is weighted to be representative of the population of adults aged 16+ in England.

Summary of results

Most people had heard of calories although awareness of reference (recommended) daily intake was relatively low, particularly for men.

Among those who had heard of calories, awareness of reference (recommended) daily intakes of calories was not strong, particularly among men. Only around a quarter of men knew their recommended level was 2,500 calories per day while nearly two-fifths of women knew their recommended intake was 2,000. When asked on average, each sex estimated a recommended level of intake that was around 90% of the actual recommendations.

Two in 3 adults reported a high or very high concern about making sure that they and their family eat a healthy diet, and 3 in 4 considered themselves knowledgeable on healthy eating – these were both higher for women.

Just over half considered themselves overweight while just under half thought they were consuming too many calories. This was more likely to be the case for women, those aged 35+ and ABC1s.

Just over half were concerned about their calorie intake (again higher for women) with the main concerns driven by being overweight, and eating too much or unhealthily.

Three in 4 parents thought their child was the right weight, but 1 in ten thought they were overweight.

Responses were generally positive to each of the suggested ways in which manufacturers, retailers, restaurants and other places where people buy food or snacks could help people manage their calorie intake. The most popular were:

Government encouraging manufacturers to develop products with fewer calories, showing reference intakes for calories on food labels and including calories on menus, manufacturers offering a wider choice of healthy and low calorie snacks, as well as doing more to take fat and sugar out of food. More than half agreed that restricting portion sizes and banning supersizing were helpful interventions. Women were more open than men to these ideas.

The options to help people manage their calorie intake that were seen as most useful were those concerning personal responsibility (having smaller portions, eating more vegetables, doing more exercise and calorie counting) followed by nudges from manufacturers (price promotions on healthy rather than unhealthy food, clearer information on calories on food labels and menus) and offering lower calorie options. A lower priority was given to getting information on recommended calorie intake and problems resulting from obesity.

Detailed results

Knowledge

Almost all adults (97%) had heard of calories, although this was slightly lower among men and adults aged under 35. There was no significant difference by social grade or self-assessed weight level.

Q2. Have you heard of calories?	All adults	Sex		Age	
		Men	Women	Under 35	35+
Base: All respondents	1061	500	556	340	541
Yes – heard of calories	97%	95%	100%^	94%	99%^

^indicates significantly higher than other subgroup eg by sex, age etc

Among those who had heard of calories, awareness of reference (recommended) daily intake of calories was not strong, particularly among men. Around a quarter of men (24%) knew their recommended level was 2,500 calories per day while 39% of women knew their recommended intake was 2,000. On average, each sex estimated a recommended level of around 90% of the actual recommendations.

Both men and women estimated that the average daily calorie intake for their gender was higher than the recommended level. On average men estimated the mean intake for their gender to be 25% more than the recommended level, and women estimated that intake was 35% higher than recommended.

Q3. And how many calories per day do you think an average man/woman in the UK needs? Q4. And how many calories per day do you think an average man/woman in the UK has?	Men		Women	
	Need	Has	Need	Has
Base: All aware of calories (men/women)	479	479	553	553
Under 1,500	7%	5%	13%	3%
1,500-1,999	5%	2%	25%	9%
2,000	16%	6%	39%	15%
2,001-2,499	6%	4%	2%	8%
2,500	24%	7%	2%	12%
Over 2,500	11%	38%	1%	19%
Mean	2305	2904	1781	2402

When asked about the reference (recommended) intakes for children, six in ten of those who had heard of calories believed that children aged up to 10 to should have fewer calories than an adult of the same gender while around 2 in ten (18%) believed these age groups should have the same or more calories. For children aged 11-15, a third believed this age group should have fewer calories (32%), with as many believing that they should have the same amount (34%).

Almost 2 in ten did not know the recommended calorie intake for each children's age group, although this was lower at 1 in ten among parents of 3-11s. Parents were more likely to believe that children aged 6-10 (18%) and 11-15 (42%) should have the same amount of calories as an adult of the same gender. By age, adults aged 45 and over were more likely to say they did not know for each age group (around 1 in four) than those aged under 45 (around 1 in ten).

Q5. For each age group below, please tick whether you think they need more , less or about the same number of calories as an adult of their gender	0-5 years	6-10 years	11-15 years
Base: All aware of calories	1037	1037	1037
More calories than an adult of same gender	13%	13%	17%
The same number of calories as an adult of same gender	8%	11%	34%
Fewer calories than an adult of same gender	61%	59%	32%
Don't know	18%	18%	17%

Self-assessed concern and knowledge

Two in 3 adults (64%) reported a high or very high concern (a score of 7 or more out of 10, where 10 is very concerned) about making sure that they and their family eat a healthy diet with 13% reporting a low level (a score of less than 5 out of 10). Women

were more likely to have a high or very high level of concern (71%) than men (57%). Those aged 65+ were more likely to have a very high level of concern (29% scoring 9 or 10) than those aged under 35 (19%). There was very little difference by social grade or self-assessed weight level.

Q1. On a scale of 1 - 10 with 10 being very concerned and 1 being not at all concerned, can you tell me how concerned you feel you are about making sure you and your family eat a healthy diet?	All adults	Sex		Age		
		Men	Women	<35	35-64	65+
Base: All respondents	1061	500	556	340	541	180
Low (1 to 4)	13%	17%^	9%	13%	12%	14%
Medium (5 to 6)	23%	26%^	20%	25%	22%	20%
High (7 to 8)	42%	37%	46%^	43%	43%	37%
Very high (9-10)	23%	20%	25%^	19%	23%	29%^
Mean	6.9	6.5	7.2^	6.7	6.9	7.0

^indicates significantly higher than other subgroup eg by sex, age etc

The majority of respondents felt they were knowledgeable about ingredients and healthy eating when choosing food for themselves and their families, with respondents slightly more confident in their knowledge about healthy eating than ingredients. Around 4 in ten felt they were very knowledgeable about each (a score of 8 or more out of 10) while around 3 in 4 felt they were at least fairly knowledgeable (a score of 6 or more): 72% for ingredients, 79% for healthy eating. Women were more likely to report being knowledgeable about each topic than men. Those with a high level of concern about their family's nutrition were also more likely to report being knowledgeable on each topic.

While there was also a small difference by social grade in the mean score out of 10 for knowledge about ingredients (ABC1 6.8, C2DE 6.4) ABC1s were not more likely to report being very knowledgeable (8-10) or not knowledgeable (1-3) and there was no difference in knowledge levels for healthy eating. There was little difference by self-reported weight level for either topic.

Q18. On a scale of 1 - 10 with 10 being very knowledgeable and 1 being not at all knowledgeable, can you tell me how you knowledgeable you feel you are about the following when choosing food for you and your family:	All adults	Sex		Concern about nutrition		
		Men	Women	Low/Med (1-6)	High (7-8)	Very high (9-10)
Base: All respondents	1061	500	556	382	448	231
A) Ingredients						
Not knowledgeable (1-3)	13%	17%^	8%	19%^	9%	8%

Q18. On a scale of 1 - 10 with 10 being very knowledgeable and 1 being not at all knowledgeable, can you tell me how you knowledgeable you feel you are about the following when choosing food for you and your family:	All adults	Sex		Concern about nutrition		
		Men	Women	Low/Med (1-6)	High (7-8)	Very high (9-10)
Base: All respondents	1061	500	556	382	448	231
Not very knowledgeable (4-5)	16%	18%	14%	25%^	13%	6%
Fairly knowledgeable (6-7)	34%	35%	34%	34%	38%^	27%
Very knowledgeable (8-10)	38%	30%	44%^	22%	39%^	59%^
Mean	6.61	6.13	7.02^	5.7	6.79^	7.7^
B) Healthy Eating						
Not knowledgeable (1-3)	8%	12%^	4%	14%^	5%	4%
Not very knowledgeable (4-5)	14%	16%	12%	25%	8%	7%
Fairly knowledgeable (6-7)	37%	38%	35%	38%	43%	23%
Very knowledgeable (8-10)	42%	33%	49%^	24%	43%^	66%^
Mean	6.92	6.49	7.3^	6.1	7.15^	7.92^

^indicates significantly higher than other subgroup eg by sex, age etc

Self-reported weight level and related concerns

Over half of adults who had heard of calories reported that they were overweight (55%), with the majority of these being just slightly overweight (36%). In addition, 36% reported being the right weight for their height while 7% reported being underweight. Women were more likely to report being overweight (60%) than men (50%), particularly being quite overweight (16% cf. 11%). Those aged 16-24 were a little more likely to say they were underweight (14%) and less likely to say they were overweight (35%) than older respondents. Respondents aged 45+ were particularly likely to report being overweight (61%). There was no significant difference in self-reported weight level by social grade or concern about nutrition.

Q16. Thinking about your weight at the moment which of the following best describes you?	All adults	Sex		Age		
		Men	Women	16-24	25-44	45+
Base: All aware of calories	1037	479	553	156	341	540
Very overweight	5%	4%	6%	3%	5%	7%^
Quite overweight	14%	11%	16%^	6%	17%^	14%^
Slightly overweight	36%	34%	37%	27%	31%	41%^
The right weight for my height	36%	42%^	32%	48%	36%	33%
Slightly underweight	6%	6%	5%	11%	6%	4%

Q16. Thinking about your weight at the moment which of the following best describes you?	All adults	Sex		Age		
		Men	Women	16-24	25-44	45+
Base: All aware of calories	1037	479	553	156	341	540
Quite underweight	1%	1%	1%	3%	1%	1%
Very underweight	*	*	*	-	1%	0%
Don't know	2%	2%	2%	3%	3%	1%
NET : Overweight	55%	50%	60%^	35%	53%^	61%^
NET : Underweight	7%	7%	7%	14%^	7%	5%

^indicates significantly higher than other subgroup eg by sex, age etc

Slightly fewer adults believed that they are eating too many calories (45%) than believed they are overweight, while 33% believed that they get the right amount of calories, and 10% believed they do not get enough.

Men were more likely than women to think they get the right amount (38%) with women more likely to feel they get slightly too many (35%).

By age, those under 35 were more likely to feel they get too few calories (17%) or the right amount (39%), while those aged 35+ were more likely to feel they get slightly too many (35%) than younger respondents.

Those who reported being overweight were more likely than average to feel they have too many calories (66%).

Q6. Overall, given your lifestyle, how would you describe the amount of calories you have on a daily basis?	All adults	Sex		Age		Over weight
		Men	Women	16-34	35+	
Base: All aware of calories	1037	479	553	156	341	540
I have too few calories	2%	2%	2%	4%^	1%	2%
I have slightly too few calories	8%	7%	9%	13%^	6%	6%
I have about the right amount of calories	33%	38%^	29%	39%^	32%	19%
I have slightly too many calories	32%	29%	35%^	27%	35%^	45%*
I have too many calories	13%	11%	14%	9%	13%	21%*
Don't know	12%	13%	11%	8%	13%^	7%
NET : Too few	10%	10%	11%	17%^	7%	8%
NET : Too many	45%	40%	49%^	36%	48%^	66%*

By social grade, ABC1s were only slightly more likely to think they are taking in too many calories (48 %) as C2Ds (41%).

Those with a higher level of concern about nutrition were more likely to report taking in the right amount of calories (35%) compared with those with a lower level of concern who were relatively more likely to say they don't know (24%), or that they have too few (8%).

Q6. Overall, given your lifestyle, how would you describe the amount of calories you have on a daily basis?	All adults	Social grade		Concern about nutrition		
		ABC1	C2DE	Low (1-4)	Medium (5-6)	High (7-10)
Base: All aware of calories	1037	603	434	128	239	670
I have too few calories	2%	2%	3%	7%^	2%	1%
I have slightly too few calories	8%	7%	9%	8%	7%	8%
I have about the right amount of calories	33%	33%	34%	22%	35%^	35%^
I have slightly too many calories	32%	34%	29%	26%	32%	33%
I have too many calories	13%	14%	12%	13%	10%	14%
Don't know	12%	11%	13%	24%^	14%	9%
NET : Too few	10%	9%	12%	14%	9%	10%
NET : Too many	45%	48%^	41%	39%	42%	47%

^indicates significantly higher than other subgroup eg by sex, age etc
* indicates significantly different from ALL adults

Around half of those who were aware of their calorie intake were concerned about it (53%) although most were just a little concerned (41%). Women were more likely to be concerned (59%), as were those with a high level of concern about their family's nutrition (57%) and those who considered themselves overweight (70%).

Q7. How do you feel about the amount of calories you are generally having?	All adults	Sex		Concern about nutrition		Over weight
		Men	Women	Low/Med (1-6)	High (7-10)	
Base: All aware of calorie intake	923	421	498	306	617	526
I'm concerned about it	12%	8%	15%^	8%	14%^	18%*
I'm a little bit concerned	41%	38%	44%	35%	44%^	52%*
I'm not really concerned	33%	37%^	30%	40%^	30%	25%
I'm not concerned at all	13%	16%^	10%	15%	12%	4%
Don't know	1%	1%	1%	2%^	0%	<0.5%
NET : Concerned	53%	46%	59%^	43%	57%^	70%*
NET : Not concerned	46%	53%^	40%	55%^	42%	29%

^indicates significantly higher than other subgroup eg by sex, age etc
* indicates significantly different from ALL adults

Reported weight of child and related concerns

Parents were asked about the weight of their child (if they had more than 1 they were asked to choose the child with the most recent birthday). 3 in 4 parents felt their child was the right weight, while 12% each thought their child was over or underweight, this usually only slightly. This assessment was similar for boys and girls.

Q17. Thinking of your boy/girl aged xxx, which of the following statements would you say applies to them?	All with children	Sex	
		Boy	Girl
Base: Parents of children aged 3-11aware of calories	172	95	77
Very overweight	0%	0%	0%
Quite overweight	2%	0%	4%
Slightly overweight	11%	11%	12%
The right weight for their height	75%	76%	74%
Slightly underweight	10%	13%	7%
Quite underweight	2%	1%	4%
Very underweight	0%	0%	0%
Don't know	0%	0%	0%
NET : Overweight	12%	11%	15%
NET : Underweight	12%	14%	11%

Two in 3 also felt their child had the right calorie intake (64%), with 18% thinking their child's calorie intake was too high and 9% too low, and with no significant different by sex of child.

Q10. Overall, how would you describe the amount of calories your boy/girl aged xxx has on a daily basis?	All with children	Sex	
		Boy	Girl
Base: Parents of children aged 3-11aware of calories	172	95	77
He\She has too few calories	2%	1%	3%
He\She has slightly too few calories	7%	5%	10%
He\She has about the right amount of calories	64%	63%	64%
He\She has slightly too many calories	15%	16%	13%
He\She has too many calories	4%	4%	3%
Don't know	9%	11%	6%
NET : Too few	9%	7%	13%
NET : Too many	18%	19%	16%

Of those who knew their child's calorie intake, 30% said they were concerned about it (most just a little: 21%) while 69% were not concerned, although only 25% were not concerned at all.

When asked about their reasons for concern or lack of this, parents without concerns gave similar reasons as had all adults about themselves: their child had a healthy diet and was the right weight. For those parents with concerns, however, the reasons were different to those given by adults: rather than talking about needing to lose weight, parents tended to talk instead about the need for their child to have a healthier diet.

Q11. How do you feel about the amount of calories your your boy/girl aged xxx is generally having?	All with children	Sex	
		Boy	Girl
Base: Parents of children aged 3-11aware of calorie intake of child	158	85	73
I'm concerned about it	9%	9%	8%
I'm a little bit concerned	21%	22%	20%
I'm not really concerned	44%	46%	42%
I'm not concerned at all	25%	22%	27%
Don't know	1%	0%	2%
NET : Concerned	30%	32%	29%
NET : Not concerned	69%	68%	69%

Response to ideas to help manage calories

Respondents who had heard of calories were shown a list of ways in which manufacturers, retailers, restaurants and other places where you buy food or snacks could help people manage the number of calories they have and asked to what extent they agreed or disagreed with each. A majority agreed with each statement but the ideas which directly impacted on consumer choice were less popular.

Q14. How much do you agree or disagree with each of these ideas?	Agree			Disagree		
	Net	Strongly	Tend to	Net	Strongly	Tend to
Base: All aware of calories (1037)						
It's important that food and drink manufacturers offer a wide choice of healthier snacks, such as ones with fewer than 100 calories	84%	27%	57%	11%	2%	8%
The British government is right to encourage food and drink manufacturers to change their recipes and develop products with fewer calories and less sugar	82%	32%	50%	13%	4%	10%
Food labels should tell you the recommended total calorie intake per day as well as the amount of calories that food contains	82%	27%	54%	13%	3%	10%
Manufacturers should do more to take fat and sugar out of my food	80%	29%	51%	15%	3%	12%
Menus should include the number of calories in food and drinks	79%	29%	50%	15%	3%	13%
Individual portions or meals should be limited to the recommended number of calories for that	66%	15%	50%	28%	6%	22%

Q14. How much do you agree or disagree with each of these ideas?	Agree			Disagree		
	Net	Strongly	Tend to	Net	Strongly	Tend to
Base: All aware of calories (1037)						
meal						
Supersizing and special offers that encourage people to eat more should be banned	59%	22%	37%	34%	8%	26%
Manufacturers should help reduce the number of calories we eat by making the portions smaller	58%	16%	42%	35%	7%	28%

Those with a medium to high level of concern about their family's nutrition were more likely to agree with all eight ideas and those who considered themselves overweight were also more receptive to most ideas. Women were more open than men to restricting portion sizes, banning supersizing, putting calories on menus and manufacturers offering healthier snacks.
Those who had heard of calories were also shown a list of ways some people manage their calorie intake, and were asked which they might find useful. 2 in ten were not interested in any of these (19%), this finding was higher for men (24%).

Women were more interested than men in a number of measures, particularly those relating to personal responsibility, but also getting calories on menus and lower calorie options.

ABC1s were also more interested in having calories on menus than C2DEs.Those who considered themselves overweight were more interested than average in measures that require personal responsibility. While not shown below, those with a higher concern for their family's nutrition were more interested in all options.

Q13. Here are some things that people say would help them have fewer calories. Which, if any, of these do you think would be helpful for you?	All adults	Sex		Social grade		Over weight
		Men	Women	ABC1	C2DE	
Base: All aware of calories	1037	479	553	603	434	540
Having smaller portions	39%	31%	45%^	41%	36%	49%*
Eating more vegetables in a meal	35%	31%	40%^	36%	35%	42%*
Doing more /plenty of activity / exercise rather than have less calories	32%	25%	38%^	33%	30%	39%*
Be conscious of the number of calories I'm eating	27%	23%	31%^	28%	26%	36%*
More price promotions on healthy foods	26%	20%	32%	27%	25%	29%

Q13. Here are some things that people say would help them have fewer calories. Which, if any, of these do you think would be helpful for you?	All adults	Sex		Social grade		Over weight
		Men	Women	ABC1	C2DE	
Base: All aware of calories	1037	479	553	603	434	540
Clearer information about calories on food labels	23%	21%	25%	24%	23%	26%
Having lower calorie options, eg recipes or prepared foods with fewer calories such as less cheeses on pizza	18%	14%	22%^	19%	17%	22%
More information on the number of calories in takeaways/restaurant food	18%	14%	21%^	21%^	14%	20%
Fewer price promotions on unhealthy foods	17%	15%	19%	19%	15%	19%
More information on how many calories I should eat	17%	15%	18%	16%	18%	19%
Being aware of the health problems of being overweight/obese	16%	15%	17%	15%	17%	18%
More information on the number of calories in take away sandwiches / breakfasts	14%	12%	17%	16%	13%	17%
Less advertising	6%	7%	5%	6%	6%	6%
I'm not interested in having fewer calories	19%	24%^	15%	20%	19%	10%

^indicates significantly higher than other subgroup eg by sex, age etc
* indicates significantly different from ALL adults

There were also some differences in interest by age. Those aged under 25 were less likely to be interested in any options. Eating more vegetables appealed more to those aged 35+, while lower calorie options and reducing advertising appealed more to those under 35 and price promotions were more attractive to those aged 25-44.

Q13. Here are some things that people say would help them have fewer calories. Which, if any, of these do you think would be helpful for you?	AGE					
	16-24	25-34	35-44	45-54	55-64	65+
Base: All aware of calories	156	165	176	197	163	180
Having smaller portions	22%	34%^	40%^	44%^	40%^	46%^
Eating more vegetables in a meal	32%	33%	36%	32%	42%	37%
Doing more /plenty of activity / exercise rather than have less calories	28%	32%	36%	36%	29%	30%
Be conscious of the number of calories I'm eating	19%	28%	25%	29%	28%	32%^

Q13. Here are some things that people say would help them have fewer calories. Which, if any, of these do you think would be helpful for you?	AGE					
	16-24	25-34	35-44	45-54	55-64	65+
Base: All aware of calories	156	165	176	197	163	180
More price promotions on healthy foods	24%	32%^	33%^	27%	26%	18%
Clearer information about calories on food labels	19%	24%	21%	23%	27%	26%
Having lower calorie options, eg recipes or prepared foods with fewer calories such as less cheese on pizza	23%^	28%^	15%	17%	12%	16%
More information on the number of calories in takeaways/restaurant food	20%	20%	12%	19%	16%	20%
Fewer price promotions on unhealthy foods	18%	18%	15%	21%	20%	14%
More information on how many calories I should eat	19%	15%	16%	15%	16%	19%
Being aware of the health problems of being overweight/obese	13%	15%	14%	15%	18%	20%
More information on the number of calories in take away sandwiches / breakfasts	15%	19%	13%	14%	13%	14%
Less advertising	10%^	10%^	3%	4%	4%	5%
I'm not interested in having fewer calories	26%^	17%	15%	20%	19%	20%

Appendix 5: Summary of stakeholder engagement to inform the calorie reduction programme

In November and December 2017 Public Health England (PHE) met with 21 food industry businesses, including manufacturers, retailers, eating out of the home businesses and 1 non-governmental organisation (NGO) representing over 40 public health organisations.

Manufacturers and eating out-of-home businesses, including takeaways, were identified on the basis of having significant market share within the food categories relevant to the programme. This included some businesses that have, to date, been less actively engaged with the reformulation programme. Food categories were determined by data from the National Diet and Nutrition Survey and from Kantar Worldpanel which was also used to calculate market share. Additional eating out of home businesses were included to reflect the commitment to widen engagement with this sector; to recognise the sector's increasing contribution to calorie intakes; and that this new programme will have a greater impact on the sector compared with sugar reduction. All stakeholders were offered the opportunity to write to PHE follow their meeting.

The main aims of the meetings were to obtain information on:

- existing business activity on calorie reduction including product reformulation, portion size and shifting purchasing towards lower calorie options, as well as the nature and size of these changes
- additional current or future plans in these areas
- technical or other issues associated with this work

The main areas discussed are set out below and a full list of those met with is included as Annex 1.

General reaction to calorie reduction

The majority of businesses expressed their commitment to reformulation, and talked about achievements to date.

Businesses were keen to understand the proposed categories to be able to consider the potential impact of the programme on their product portfolio and overall business, and to provide a focus for their thinking on options for calorie reduction.

There was a general view that for businesses with a broader product offer, a 20% overall calorie reduction was achievable, but that achieving this in every category would be difficult.

Calorie reduction was felt to be achievable to deliver in some product categories, eg ready meals and pizza. However, businesses thought that at this early stage a significant reduction in calories may not be achievable in other categories, or within some parts of their individual product portfolio.

Achievements to date

Although some businesses had taken specific action most progress on reformulation to date covered sugar, fat and salt, reductions in portion size, and the introduction of healthier ranges or options.

Some out-of-home businesses provided information on their current healthier/lower calorie offer.

Commercial concerns

A number of businesses mentioned the need to balance reformulation against other business priorities.

Businesses felt there needed to be a ‘level playing field’, both within and between sectors. Within sectors, concerns related to the risk of customers potentially switching to other brands if too great a change was made too quickly and any resulting market disadvantage. Between sectors, some businesses felt they were restricted in the action they could take due to the businesses they supplied or how widely their products were stocked; while others confirmed that they were being asked to take relevant action. A third group indicated that they were reliant on what other businesses would supply them with.

There were some particular concerns raised about some parts of businesses portfolios as being more difficult to change; some businesses felt these should be out of scope of the programme.

Most businesses mentioned consumer acceptance as an important consideration in the pace of reformulation. Possible changes in taste were highlighted, as were changes in portion size particularly when related to price. Some businesses felt there needed to be industry or sector-wide change to ensure a level playing field while others were focusing on alternative mechanisms for action.

A phased approach was considered to be most effective, with some businesses reporting success in making changes ‘by stealth’ or over a long period of time to address potential consumer resistance.

Some businesses were concerned about being perceived as ‘holier-than-thou’ if promoting healthier or lower calorie products. However, others felt that taking such actions would be more effective than reformulation and some had already achieved some positive change via this mechanism.

Businesses with a smaller range of products, or where all or most of their portfolio was likely to be included in the calorie reduction categories, were particularly concerned about achieving the required changes and the impact this may have.

Technical

Some businesses said that changes in types of products or portion or product sizes would require changes to manufacturing processes which would take time to implement and may impact on resource.

The methodology of achieving calorie reduction was discussed with some businesses considering that some ways of reformulating recipes may not have a significant impact on calories. Others felt they had already reached the boundaries of what was possible. Some also highlighted the challenge of achieving a balance across calories, fat, sugar and salt.

Others mentioned the need for ‘clean labels’ and the challenges this created; and the possibility of increases in waste if portion size was reduced, or leaner meat was used.

Labelling

Some businesses were of the view that for a reduced calorie alternative to be offered there had to be a standard product to offer it against.

It was confirmed by PHE that products marked as providing more than 1 portion will be considered in the way they’re typically eaten rather than as specified on the label. Some businesses said that they are already looking at single-serve sizes; at being clearer on serving size on pack; or were considering reducing the size of sharing products to reduce the portion size for individuals.

The different methods used to provide calorie information in the out of home sector was discussed. Some businesses identified the lead-in-time needed to update physical resources as a barrier to providing labelling at point of sale.

Guidelines and monitoring

Businesses felt that the use of broader product categories would provide more options for action on calorie reduction. Others said that having the same categories as already set for salt and sugar reduction was thought to be easier for businesses to focus on and monitor internally.

Businesses which had made significant progress in reformulation were concerned that this may not be reflected depending on the baseline year used for the programme. PHE confirmed that it was committed to working with businesses to supporting their achievements using a narrative approach in the same way that is being used for the sugar reduction programme.

Out-of-home/takeaway businesses were concerned at how progress would be measured where data was not readily available (for example contract catering in schools), or difficult to measure accurately (eg a ‘make your own’ sandwich offer or a choice of side dishes with a meal).

PHE also met with the Obesity Healthy Alliance, a NGO which represents over 40 health charities, medical royal colleges and campaign groups. In the meeting they welcomed the plans for calorie reduction, and expressed their support for ambitious targets and long-term commitment. They supported the importance of publishing comprehensive and transparent benchmark and progress data at regular milestones, and welcomed the setting up of an independent obesity reference group. They raised the issue of the need for and the challenges of greater consumer awareness about calories, and that they would use data to inform their support and approach.

Annex 1: Table of organisations met with

The table below shows which organisations attended a meeting with PHE, by sector, and which of these followed up in writing. Those that did predominantly covered technical detail that will be considered as the programme develops in consultation with industry and NGOs.

Sector	Company	Written Response
Retailers	Aldi	
	Asda	
	Morrison's	
	Sainsbury's	
	Tesco	Yes
Manufacturers	Birds Eye	
	Dr Oetker	Yes
	Hain Daniels	
	KP	
	Kraft Heinz	
	Premier Foods	
	Princes	Yes
	PepsiCo	Yes
Out of home/takeaway businesses	Burger King	
	Casual Dining Group	Yes
	Compass	
	Greggs	Yes
	McDonalds	
	Greene King	
	Pizza Express	
	Subway	Yes
Non-governmental organisations	Obesity Health Alliance (represents around 0 individual non-governmental bodies)	Yes

Appendix 6: Estimated health economic benefits of a calorie reduction programme

The Department of Health and Social Care (DHSC) was commissioned by Public Health England (PHE) to estimate the potential impact of a calorie reduction programme at a population level. This is divided into 2 main measures:

- health impacts and the potential benefits to people's health from reduced levels of overweight and obesity
- wider economic benefits, for example through reduced health and social care costs

This summary describes the data sources, methodology, limitations and assumptions of the modelling calculations.

For the foods included in the modelling it was assumed that calories per portion would be reduced through product reformulation and portion size reduction.

A number of different potential ambitions were modelled – these were 5%, 10%, 20% and 30% calorie reduction due to reformulation. However, data has only been presented in the main body of the report (above) for the ambition that was likely to be chosen for the programme. This decision was made through consideration of the feasibility insights from the salt and sugar reduction programmes, the soundings from food industry businesses and others on potential action around calories and the level of excess calories consumed by children.

Table 1 gives more detail on how the foods were defined by PHE and those in the National Diet and Nutrition Survey (NDNS). Although these do not align exactly, due to the nature of how the NDNS is recorded, they both cover the same foods. For example, ready meals are not a separate category in NDNS, but are instead recorded within the food type. Some foods are not covered specifically by the NDNS, such as bread with additions or "food to go" (eg ready-made sandwiches, prepared salads etc.). It is assumed that these foods are sufficiently covered in the other categories.

Finally, the timescale for achieving the reductions was set as 5 years and the impact was assessed over a 25 year period.

An important caveat to the results is that this model only assesses the outcomes associated with 1 particular scenario. It does not consider alternative ways of achieving calorie reduction. The model uses a specific population, defined further below, and assesses the impacts of full implementation of the scenario over a defined time period. The impact on future generations is out of scope of this work.

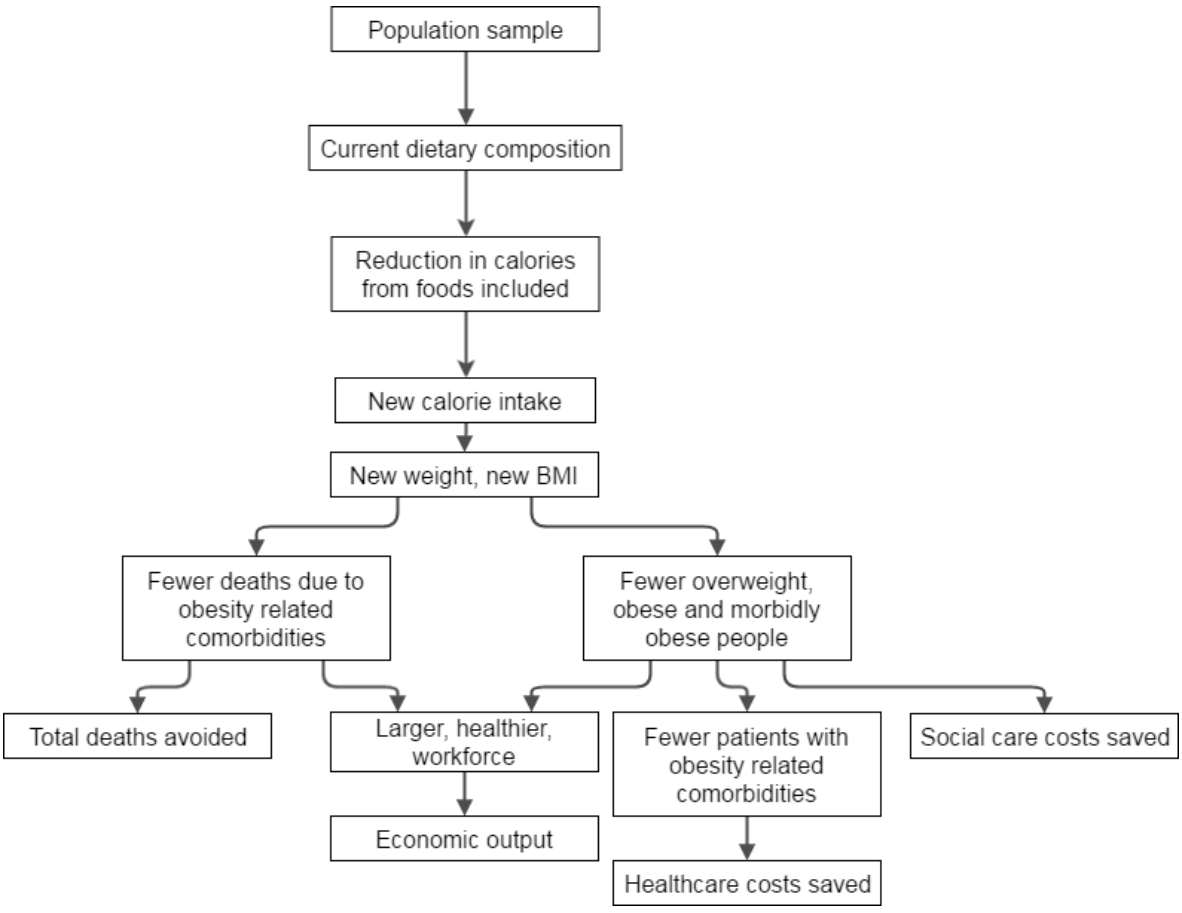
Methods

The general structure of the model is displayed in Figure 1 below. The impacts on the initial population samples, as set out below, are projected for a period of 25 years. The model is formed of a number of discrete sections: dietary changes, weight changes, obesity-related health implications, and economic benefits.

Each population sample's current diet and calorie intake were estimated. The estimated reductions from the foods included were then applied to these data to create a new estimated calorie intake, resulting in a new weight and Body Mass Index (BMI).

Each population sample therefore suffered fewer deaths due to obesity related comorbidities. However, individuals remained in the same sample regardless of their projected weight change. Together this lead to a larger, healthier workforce which generated an increased economic output (the full quantitative estimate has not been provided here). Fewer overweight and obese people resulted in fewer patients with obesity related comorbidities and therefore savings to healthcare costs and a reduced demand for social care.

Figure 1: High- level overview of model structure



Data sources

The population samples used for the modelling are estimates of those currently overweight, obese and morbidly obese. Office for National Statistics Population Estimates (3) were used to estimate the total population, by age and gender. Health Survey for England (HSE) data (2) were used for the proportions of those who are overweight, obese and morbidly obese. This resulted in an initial population of 26,400,000, of which 15,200,000 were overweight, 9,980,000 were obese and 1,230,000 were morbidly obese (rounded). In the model, this is further broken down by age and gender.

Dietary composition was estimated using NDNS data from years 2012/13 and 2013/14 (4) for different age-gender groups. From this the number of calories consumed in each food category were estimated. This figure was then used to calculate how many fewer calories would be expected to be consumed if the reduction figures being modelled were achieved.

HSE data was used to predict the average change in BMI through calorie reduction. As the weight changes in the population samples were projected throughout the 25 year period, the PHE weight management economic assessment tool(5) was used to estimate BMI adjustments, for example, the annual expected increase in BMI by age and sex.

To predict the new incidences of obesity related comorbidities, the World Obesity Forum figures (6), published in 2012 which give the relative incidence per unit increase in BMI were used.

The reductions to be achieved and the timeline for the programme were set by PHE.

Obesity-related health implications

The modelling of obesity-related health implications is predominately based on the PHE weight management economic assessment tool (5). This tool is designed to help public health professionals make an economic assessment of existing or planned weight management interventions.

NHS costs for prevalent cases of heart disease, stroke, colorectal cancer and breast cancer were estimated using the National Programme Budgeting data from 2012/13(9). The total cost was divided by estimates for the prevalence of the relevant condition to calculate the cost each year per person (5). This figure was then uplifted for inflation using the Hospital and Community Health Service 2016 data (10).

Change in weight following reduced calories consumed

Outcomes were derived only for those aged 4 to 79 years who are overweight, obese or morbidly obese at the outset. It was assumed that reductions in calorie intake are likely to have minimal impact on the health of healthy weight and underweight people and these groups were therefore excluded.

The estimate of weight change was derived from the absolute change in total calories resulting from achievement of the calorie reductions in each group of foods. It was assumed that, on average, every 100 kilojoule reduction in energy intake would eventually result in a 1kg loss in weight, 95% of which is lost in about 3 years. This is equivalent to 0.042kg lost per food calorie reduced, ie 1kcal (7). For simplicity, the model assumed that weight is lost in a linear manner over a three-year period.

The weight change calculation expresses changes in terms of weight loss. In order to calculate the health impacts of changes in obesity levels weight changes were converted to changes in BMI. An expected change in BMI was calculated for each age-gender-BMI sub-group. The modelling of weight reduction is constant within each age-gender group across the different weight categories. The estimated reduction in weight for a given reduction in calorie intake increases as total weight increases. Given individuals in the obese and morbidly obese groups naturally weigh more than those in the overweight group, it is expected that the model underestimates BMI loss for all groups, with especially large underestimates in the higher weight groups.

Data limitations

An important caveat is that a reduction in calorie consumption may not reduce total energy consumption by the full amount expected. This is because the calories taken out of the foods included in the modelling may be replaced by calories from other food or drink, partially offsetting any reduction in calories (1). There is no consensus in the evidence around the expected rate of this ‘calorie offsetting’. The rate is likely to depend on the policy interventions used to target a reduction in calorie consumption as well as variations in consumer behaviour. For the purposes of this modelling, it was assumed that no calorie offsetting occurs.

In addition, it is important to note the main caveat surrounding data from the NDNS. This is the presence of underreporting of food and drink consumed by survey participants leading to an underestimate of calorie consumption. This can occur for a number of reasons and less healthy food and drink tend to be most underreported. More detail on this is provided in Appendix 2. It is important to note here, though, that it is not possible to extrapolate the estimates of underreporting to the full population included in this modelling (8). The presence of underreporting in the NDNS also means that our estimated outputs will be underestimates.

Economic costs

The estimated savings in social care costs are based on the methodology used in the PHE weight management economic assessment tool (5). The association between BMI and self-reported need for help with the usual activities of daily living was used as the basis for the estimation of community-based social care costs by BMI, age and sex(5). For each BMI and age-gender group, the model used this association to estimate the number of individuals requiring social care. These figures were then combined with the typical cost of home care per hour, the proportion of care need which is met and the typical hours of help received from local authorities to calculate social care costs.

It is important to note that these costs are for community based social care and do not extend to costs in the care home population. The social care cost savings account for the reduced burden on social care workers from a less overweight/obese population.

Obesity is associated with a reduction in economic output and an increase in the prevalence of chronic diseases which cause premature mortality. As a result, the achievement of the calorie reductions modelled would be expected to increase economic output through additional labour force participation. Due to a number of uncertainties around the relationship between obesity related morbidity and labour force participation this has not been estimated quantitatively in this analysis.

Relation to sugar reduction targets and wider childhood obesity work

The outcomes estimated here are smaller than those proposed in ‘Sugar reduction: The evidence for action’(11). In that document, the outcomes were estimated assuming the achievement of recommendations for sugar intakes from the Scientific Advisory Committee on Nutrition (reduction of free sugar intake to a maximum of 5% total calorie intake) and many food group categories were taken into account within the modelling work. For the calorie reduction modelling, inclusion was limited to the food categories within the calorie reduction programme. For example, under the 20% reformulation ambition calorie consumption would be expected to reduce by 83kcals for males aged 19-64, assuming the ambition is achieved in 5 years. However, under the SACN recommendations, the estimated calorie reduction for the same age-gender group is 149kcals.

Baselines

There is naturally some overlap between the scope of the calorie targets, the sugar targets and the wider Childhood Obesity Programme (COP). The assumption that calorie reduction has already been made due to measures in place within the COP was therefore considered. However, the same scale of benefits is seen, regardless of whether these take place before or after other calorie reductions. This is because the

model is largely additive, ie if the calorie reduction estimates doubled, the outcomes would be expected to roughly double as well.

The baseline level of overweight and obesity is what will happen if nothing is done. For modelling simplicity, the baseline for the calorie reduction model is the same as that for the sugar reduction model. Therefore, there may be a slight overestimation of the impacts measured. However, for the reasons explained above, these should not be large.

Quality Assurance

The model used here has been adapted from the model used for the sugar reduction program which was quality assured at the time(11). The changes have since been quality assured internally by an independent analyst at DHSC in line with usual procedures.

In addition, the Weight Management Economic Assessment Tool produced by PHE was developed in conjunction with a panel of experts (5).

Table 1: Foods included in the modelling and the corresponding best fit categories from the National Diet and Nutrition Survey

Group 1 foods	Example of products	NDNS Food Group Codes and Descriptions
Breads with additions	Chilled/frozen/ambient bread containing cheese, garlic butter, olives, sun-dried tomatoes etc. Excludes plain bread, morning goods.	
Crisps and savoury snacks	All standard potato crisps . Also includes extruded, sheeted, pelleted snacks, poppadums. Excludes popcorn (included in sweet confectionery).	42 Crisps and savoury snacks: Includes all potato and cereal based snacks, popcorn (not sweet), twiglets, pretzels, pork scratchings.
Savoury biscuits and crackers and crispbreads	Crackers, filled and unfilled savoury biscuits, savoury rice cakes and cheese and onion twists breadsticks.	7A Biscuits manufactured: all types of purchased/retail biscuits, sweet and savoury. Includes cream crackers, flapjacks, breadsticks, oatcakes, rice cakes, crispbread, cereal bars, ice cream cornet/wafers, gluten free biscuits.
Potato products	Chilled, frozen oven chips, takeaway chips, waffles, potato shapes etc. and mashed or creamed potatoes. Excludes plain, raw potatoes;	38A and C Chips, fried and roast potatoes and potato products: any type of purchased/retail or takeaway chips or French fries, including fresh and frozen, oven and microwave. Any other type of

	instant mashed potato	purchased/retail potato product such as roast potato, sliced potato with or without batter, waffles, croquettes, crunchies, alphabites, fritters, hash browns, wedges. Fried, grilled or baked.
Meat products Subcategory 1: Cooked sausages and sausage meat products, frankfurters, hotdogs, and burgers and grillsteaks	All fresh, chilled and frozen meat sausages, eg pork, beef, chicken, turkey, etc. black and white puddings. Includes all standard, speciality and topped burgers and grill steaks eg fresh and frozen burgers and grillsteak, beef burgers, hamburgers, pork/bacon burgers, and all kebabs.	29 Burgers and kebabs: Any type of purchased/retail or takeaway burger or kebab products including beefburgers, hamburgers, cheeseburgers, (with or without roll) doner/shish/kofte kebabs (with or without pitta bread and salad), grillsteaks, steaklets. Not homemade burgers or kebabs, not chicken. 30A Ready meals based on sausages: Any type of manufactured product/ready meal eg toad in the hole, sausage and mash. 30B Other sausages: All types of sausage and homemade sausage dishes, including takeaway. Beef, pork, chicken/turkey sausages, polony, sausage in batter, saveloy, frankfurters, sausage casseroles, toad in the hole, sausage meat stuffing, canned sausages. Not sausage rolls. 32A Other meat products (manufactured including ready meals): Any other type of purchased/retail meat products, canned meat or ready meal, including pepperami, corned beef, luncheon meat, meat paste, meat loaf, black/white pudding, faggots, haggis, salami, haslet, tongue, garlic sausage.
Meat products Subcategory 2. Meat, fish, vegetarian pastry pies	Chilled/frozen/ambient meat, fish pies and Other meat-based pastry products including pies and slices, canned and frozen products, Cornish and meat-based pasties, delicatessen, pork pies and sausage rolls. Also includes products such as cheese pies/rolls.	31A and B Meat pies and pastries: Any type of purchase/retail meat pies and pastries: chicken, turkey, beef, ham, steak and kidney, pork pies, game pie, meat samosas, meat pancake rolls, cornish pasties, sausage rolls. Homemade meat pies and pastries.
Cooking sauces and pastes	Chilled/frozen/ambient pasta sauce, curry sauce, pesto, thick pastes etc.	(In NDNS cooking sauces and pastes used for homemade dishes will be reported as part of the food group appropriate for the dish.)

Table sauces and dressings	Chilled/frozen/ambient tomato ketchup, brown sauce, salad cream, mayonnaise, salad dressing etc.	50R Savoury sauces pickles gravies and condiments: Includes white sauces, cook in sauces, sauce mixes, tomato ketchup, Bovril/Marmite, pickles, chutney, stuffing, gravy, mayonnaise, salad cream and dressings, yeast, stock cubes, dried herbs and spices and tomato puree.
Pasta/rice/noodles	Pasta/rice/noodles in sauce, pasta/rice/noodles based ready meals or meal centres. including chilled, frozen, ambient, canned, ambient products and chilled stuffed pasta. Excludes plain dried pasta, rice and noodles and homemade.	1D Pasta (manufactured products and ready meals): All types of purchased/retail products or ready meals based on pasta or noodles; including filled fresh pasta and canned pasta. 1F Rice (manufactured products and ready meals): All types of purchased/retail products or ready meals based on rice; includes ready meal risotto, ready cooked rice. Not purchased rice pudding. Not takeaway rice dishes.
Ready meals with carbohydrate accompaniment.	Chilled/frozen/ambient all Chinese, Thai, Italian, traditional, vegetarian etc. meals including meat alternatives and other ready meals where a carbohydrate accompaniment is included (pasta, rice, noodles, potato, bread etc). Excludes meal kits.	(some included in meal centres below)
Meal centres Subcategory 1 - without accompaniment (potato, rice, noodles, pasta, etc.) made from fish	Fish includes processed fish and shellfish including breaded/coated (eg fish cakes, fish fingers, fish pieces in batter/breadcrumbs) and fish/shellfish with additions, dressed salad with fish, marinated fish etc. Also includes processed oily fish including tinned oily fish in tomato sauce or dressings, fish in sauce. Excludes plain fish and salmon en croute (included with meat pastry pies) and fish pie (potato topped - included in the ready meals category).	33 White fish coated or fried: Any type of white fish or roe purchased/retail or homemade, coated and/or fried. Includes battered and fried takeaway white fish, fried, grilled or baked fish fingers, fish cakes, scampi, McDonalds Fillet o Fish. 34C Manufactured white fish products (including ready meals) Any type of white fish (cod, plaice, haddock etc) product purchased/retail including ready meals, eg white fish in sauce. Not coated fish. 34E Manufactured shellfish products (including ready meals): Any type of shellfish purchased/retail product including shellfish based ready meals. Includes canned shellfish. Not takeaway shellfish products. 34G Manufactured canned tuna products (including ready meals): Any purchased/retail product based on canned tuna, including tuna sandwich fillers and purchased tuna in sauce/dressing. Includes

		canned tuna (in brine, oil (any), spring water). 35A Manufactured oily fish: Any type of oily fish purchased/retail product including canned in oil/brine/tomato, pickled, sushi, ready meals, taramasalata, pate, paste.
Meal centres Subcategory 2: without accompaniment (potato, rice, noodles, pasta, etc.) made from poultry	Poultry including processed poultry including chilled/frozen/ambient breaded, coated and chicken/turkey with additions. Excludes plain raw poultry and white meat. Includes poultry-based side dishes eg tapas and other dishes that can be consumed with or as part of a meal. Also includes chicken burgers, turkey burgers., breaded chicken, dressed salad with chicken, marinated chicken etc.	26 Coated chicken and turkey manufactured: Any type of coated chicken or turkey products purchased/retail or takeaway. Includes Kentucky Fried Chicken, nuggets, drumsticks, chicken kievs, burgers (with/without bun). 27A Manufactured chicken products (including ready meals): Any type of chicken or turkey products purchased/retail, including ready meals, sandwich fillings, canned chicken/turkey and dishes. Not chicken/turkey sausages. Not coated chicken/turkey.
Meal centres Subcategory 3: without accompaniment (potato, rice, noodles, pasta, etc.) made from red meat and pork	Chilled/frozen/ambient processed red meats (lamb, beef, pork) including red meat in sauce. Also includes dressed salad with meat, marinated meats etc. Excludes plain red meat. Includes red meat based side dishes eg tapas and other dishes that can be consumed with or as part of a meal.	22A Ready meals/meal centres based on bacon and ham: Any types of bacon and ham purchased/retail products including ready meals. 23A Manufactured beef products: Any types of beef and veal products purchased/retail, including ready meals, canned beef products and pastrami. 24A Manufactured lamb products: Any types of lamb product purchased/retail, including ready meals and canned products. 25A Manufactured pork products: Any types of pork product (not ham or bacon) purchased/retail including ready meals and canned pork products. 28 Liver, products and dishes: Any type of liver (fried, stewed, braised, grilled) and liver dishes; liver casserole, liver sausage, liver pate. Includes liver-based ready meals.
Meal centres Subcategory 4: without accompaniment (potato, rice, noodles, pasta, etc.) made from meat alternatives	Chilled/frozen/ambient all meat and fish alternative products eg sausages, burgers, bites, pies, en croute products, sausage rolls, nut cutlets, falafel, flavoured ‘meat’ pieces eg chicken fillets, ‘meatballs’, all meat-free ‘meats’ eg ham, turkey	37K Meat alternatives (including ready meals and homemade): Any type of products based on meat alternatives such as textured vegetable protein (TVP), soya mince, Quorn and tofu. Includes ready meals and homemade dishes based on these. 37L Other manufactured vegetable products (including ready meals): Any type

	etc., including 'bean burgers', 'veggie burgers' and other similar products. Excludes plain meat alternatives.	of purchased/retail vegetable products, including ready meals.
Pizza	All fresh and frozen pizza.	1C Pizza: All types - thin and crispy, deep pan, French bread, etc. Includes homemade.
Prepared dips and salads as meal accompaniments (not as main meals)	Samosas, chilled dips, hummus, coleslaw etc.	
Egg products/dishes	Pastry based quiches and flans and eggs with additions eg omelette, scotch eggs, egg mayo sandwich filler etc. Excludes plain eggs.	16C Manufactured egg products (including ready meals): Any type of manufactured/retail egg dishes including ready meals: quiches, flans, scotch eggs, meringue, pavlova, curried eggs, egg mayonnaise sandwich filler.
Food to go	Includes foods sold to eat "on the go" by retailers and the out of home sector eg sandwiches, paninis, sushi, boxed salads, pasta salads etc.	

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Appendix 7: Product categories covered by the calorie reduction programme

Product categories:

- bread with additions (eg olives, cheese etc.)
- crisps and savoury snacks
- savoury biscuits, crackers and crispbreads
- potato products (eg chips, croquettes, mashed potato etc.)
- sausages (raw and cooked) and sausage meat products, frankfurters and hotdogs, burgers
- meat, fish and vegetarian pastry pies and other pastry products
- cooking sauces and pastes
- table sauces and dressings
- pasta/rice/noodles with added ingredients and flavours
- ready meals with carbohydrate accompaniment (potato, rice, noodles, pasta, etc.) – fish, meat and meat alternatives
- meal centres without carbohydrate accompaniment (potato, rice, noodles, pasta, etc.) – fish, meat and meat alternatives
- prepared dips and composite salads as meal accompaniments (eg coleslaw, potato salad, guacamole, salsa etc.)
- pizza
- egg products/dishes (eg quiche)
- food to go eg sandwiches, boxed main meal salads etc.

Appendix 8: Timeline for the calorie reduction programme

Date	Milestone
March 2018	Publish calorie reduction ambition, timeline and supporting evidence
June/July and Autumn 2018	Two phases of stakeholder engagement to inform the development of guidelines for the product categories covered by the calorie reduction programme
Mid 2019	Publish guidelines for the product categories covered by the calorie reduction programme
Mid 2019 to August 2024	Industry action to reformulate products
March 2021	Progress report on the sugar reduction and wider reformulation programme to be published which will include the first detailed assessment of progress on the categories covered by the calorie reduction programme
August 2023 to September 2024 (52 weeks)	Data collected through contracted suppliers for food and drink consumed in and out of the home
November 2024	PHE receive data
Mid 2025	PHE publish progress towards 20%

Appendix 9: Products included in each of the reduction and reformulation programmes

Food and drink products		Salt	Sugar	Calorie reduction	Drinks included in the levy
		2017 salt targets	20% reduction by 2020 – guidelines set	20% reduction by 2024 – guidelines tbc	Levy rates set at 18p (5-7.9g sugar per 100ml) and 24p (8g sugar or more per 100ml)
Biscuits	Sweet biscuits		✓		
	Savoury biscuits, crackers and crispbreads	✓		✓	
Bread	Bread	✓			
	Bread with additions (eg ciabatta with olives)	✓		✓	
Breakfast cereals		✓	✓		
Butter and fat spreads		✓			
Cakes and morning goods		✓	✓		
Cheese		✓			
Confectionery (sweet and chocolate)			✓		
Sweet spreads			✓		

Cooking sauces (eg Italian/pasta, Indian, Chinese etc), table sauces (tomato ketchup, brown sauce, mayonnaise etc) and salad dressings		✓		✓	
Crisps and savoury snacks		✓		✓	
Eggs	Egg products	✓		✓	
	Plain eggs				
Fruit and vegetables	Fruit and vegetable juice and smoothies		✓		
	Unprocessed raw fruit and vegetables (fresh, frozen, canned etc.) including plain, raw potatoes, instant mashed potato				
	Potato products (eg chips, prepared mash, croquettes etc.)	✓		✓	
Meat, fish and meat alternatives	Meat products and processed meats, poultry, fish, meat alternatives (including plain) etc. (eg pies, pastries, sausages, burgers etc.)	✓		✓	
	Canned fish	✓			
	Unprocessed, unflavoured meat and fish				
Milk and milk substitute drinks			✓		
Yogurts and fromage frais			✓		
Ice cream and sorbets			✓		
Puddings		✓	✓		

Pasta, rice, noodles, legumes etc.	Pasta, rice and noodles, flavoured, filled etc.	✓		✓	
	Plain rice, noodles, pasta etc.				
	Baked beans	✓			
	Unprocessed grains, baking ingredients etc.				
	Other cereals	✓			
Ready meals and ready to eat food	Ready meals and meal centres including takeaways	✓		✓	
	Dips and prepared accompaniment salads (eg hummus, coleslaw, potato salad etc)	✓		✓	
	Pizza	✓		✓	
	Food-to-go (eg sandwiches, boxed main meal salads, sushi etc)	✓		✓	
	Olives				
	Soups	✓		✓	
Soft drinks					✓
Stocks and gravies		✓			